Electrical Review

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Electrical Review

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CONTENTS:

	PAGE
Some New Coherer Phenomena	333
Science Brevities	334
Electric Light in Photo-Micrography	335
American Institute of Electrical Engineers	335
The South Magnetic Pole Located	335
Electrical Standards	336
A New Electromobile Factory	337
Electromobiles in Central Park, New York City	338
The Automobile Club of America	338
A National Highway for Automobiles	338
One Way to Run an Electromobile	338
The Oelwein Shops	339
Telephone Legislation no Longer in Demand	340
Wall Street and the Electrical Stock Market	341
Important Decision on Direct-Current Ceiling Fan Patents	342
The Development of Safe and Accurate Fuse Protective Devices	342
A Novel Type of Telephone Transmitter	343
Personal	343
Telephone and Telegraph Companies of the United States Compared	343
A Military Pole-Climbing Contest	343
Small Electric Motors for Individual Machines	344
Not in a Telephone Combination	344
Independent Telephone Manufacturers	345
Automatic Motor-Starting Apparatus	345
The American Bell Telephone Company	346
Chicago Electrical Association	346
General Electric Company's Annual Meeting	346
General Electric—Siemens-Halske	346
A Handsome Cable Sample Board	347
Automobiles	347
Views, News and Interviews	348
Notes on Electric Traction Under Steam Railway Conditions	349
An Automobile Sleigh	349
Alfred F. Moore Burned Out	349
The First Link to the Trans-Pacific Cable	350
Fire Drill for Telephone Girls	350
Westinghouse Dividend	350
Detroit Three-Cent Fare Ordinance Declared Invalid	350
A Trolley-Car Electromobile Combination	351
Book Reviews	351
Obituary	351
The Automobile Club's Exhibition	351
Telephone and Telegraph	352
Southwestern Gas, Electric and Street Railway Association	352
One Big Telephone Company Predicted	352
Industrial Notes	353
Electric Railways	353
Advice on Trolley Travel	353
Advance Information	354
Combination Wall and Desk Set Telephone	354
Electric Lighting	354
Electrical Patents	27

Advertisers' Index, page 10.

The paper by Mr. Frank W. Wolff, Jr., which appears on another page of this issue, contains an exceedingly interesting account of the history of electrical measurement. We are so accustomed to regard the standards of electrical measurement as of inviolate accuracy that it is hard to believe that only twenty-two years ago an error of more than one per cent existed in the then standard ohm. The description in the article mentioned of the standards of the various governments, and especially of the Office of Standard Weights and Measures, at Washington, is of extreme interest.

The commencement of work upon the rapid transit tunnel in New York city, which was inaugurated with appropriate ceremonies on March 24, marks more than the beginning of a new enterprise; it is the commencement of a new era in conditions of living in New York city. It will mean to millions of people saving of time, immense convenience and the disappearance of grave discomforts entailed by the crowded and disagreeable elevated system, however, as there seems the new tunnel roads will displace the elevated system, however, as there seems to be reason to think that elevated, surface and underground railways will have their parts to play in the transportation of people in this city. The enterprise is one that should have been started years ago. It is greatly to be hoped that nothing will stand in the way of its successful and rapid completion.

The technology of the automobile has been enriched with a new word. In Mr. H. D. Emerson's "Observations on the Automobile," which appeared in the last issue of the ELECTRICAL REVIEW, he states that the word "bubbling" has come to mean going to ride in an automobile. He further traces the derivation of this term as through the word "automobubble," which is a corruption of "automobile." If one thinks of the steam automobile with its teakettle-full of boiling water aboard, the term seems reasonable enough, but just how it can apply to the electric automobile is hard to see unless it refers to that anxiously awaited period when the batteries are full and begin to sizzle in charging. At any rate, the art is grateful to Mr. Emerson for his word, because up to now it has not been possible to feel sure that one is correct when one says ride, drive, conduct or operate in reference to the new carriages. Therefore, let it be hereafter "bubble."

The electromobile vehicle has undoubtedly proved the ability of the modern accumulator to stand up under very much more difficult conditions of service than those of the street car under which it was not successful when given service trials about ten years ago. In Germany, to-day, as well as in France, the accumulator is again coming into vogue as a method for electric street-car driving. While it is by no means intended to advocate it as, in any sense, a rival of conducting systems, still there are many situations in which accumulator cars could be used to the greatest advantage, and it seems time that they should be given another trial with the more modern and satisfactory types of accumulators now in use. No more conspicuous example of a place peculiarly adapted for such traction service can be found than is furnished by the Twenty-eighth and Twenty-ninth street crosstown lines in New York, now operated by the noisy, unsatisfactory and dangerous compressed air motor. Granting that the expense of operation of accumulator cars would be greater than that of trolley cars in so far as the actual motive power cost is concerned, and without reference to fixed charges on a highly expensive equipment underground, still it seems that these silent, controllable and safe vehicles would possess many points of such great superiority over the present air cars, that they should at least have a trial and be allowed to demonstrate their fitness for this work.

Telephone Legislation no Longer in Demand.

A joint resolution providing for the adjournment of the New York Legislature on April 6 has been agreed to, and it is interesting to note that during the session about to close the word "telephone" has scarcely been heard. A few years ago the agitation for and against a law to regulate telephone rates was one of the loudest notes sounded at Albany during the Winter. Not more than five years ago prominent lawyers argued in favor of such a law and claimed to voice the demands of some four score business associations. In succeeding years the prominent lawyers dropped the matter, and the business associations demanding legislation gradually became fewer, until finally, with this session, not a voice was raised nor a petition signed in favor of a telephone rate bill.

The reason for this rapid wane of what at one time appeared to be an urgent public demand is doubtless to be found in the businesslike way in which the telephone service and the charges for it have been adapted to the public requirements. Up to a few years ago the conditions under which telephone service was supplied lacked elasticity. There was one rate for all classes of users, and practically one class of service. It was this rigidity of practice that aroused discontent, and the reformers scarcely knowing where the trouble was, naturally aimed at the most conspicuous object—the rate—and urged the adoption of a hard and fast rate plan. If such a rate plan had been fixed upon the various companies operating throughout the state, it would have perpetuated or, at least, greatly prolonged the existing dissatisfaction. What the public really needed, and what the companies in their own way were seeking to afford, was a more elastic policy both as regards rates and suitability of service to different classes of users. With the adoption of such a policy by the telephone companies the public soon found that it was getting what it wanted without recourse to legislation and discontent rapidly diminished.

Telephone administrations and companies more or less all over the world have been making special efforts in the past few years to suit their rates and their service to the requirements of the public, and to these efforts has responded a great growth in the use of the telephone. In no country has more been done in this direction than in the United States, and New York city, as is right and proper, is conspicuous among American cities for the enormously rapid growth of its telephone system. Five years ago, when the agitation in favor of a telephone rate bill was at its height, the company furnishing telephone service in New York city felt fairly assured of the success of its experiment with message rates, begun a year previously, and its opposition to the proposed bill was the more forcible because the bill would have killed the message rates at the very start and would have thrown the company back on a flat rate, which had been proved not suited to the mass of the public having use for the telephone service.

How large that public is has been shown by the surprising growth of the New York telephone system since the date mentioned. In the short period of five years the number of telephone stations in use in Manhattan has grown from some 10,000 odd to over 40,000—a truly phenomenal growth, accountable for only under the assumption that both rates and service are reasonably satisfactory to the public. During this period, which is about one-quarter of the total time that the telephone service has been in existence, the message rate system of charging for service has been so elaborated and refined, in the light of experience gained in its working, that telephone service is now supplied in Manhattan at a rate of $60 a year—75 per cent less than the rate formerly charged for unlimited service and 50 per cent less than the usual rate proposed in the various bills presented to the New York Legislature in former years.

Those bills invariably aimed at perpetuating the flat rate—the charge of the same rate to all subscribers alike whatever their requirements and whatever their use of the service. This system of charging, which throws on the small user the burden of paying for part of the service of the larger user, has been proved to check the growth of the telephone systems of large cities, and, wherever thorough inquiry has been made into the conditions surrounding the supply of telephone service in great centres, has been condemned as unpractical and inequitable. Such, for example, was the opinion reached by a Parliamentary Committee, in London, two years ago, after hearing the evidence of a large number of experts and business men. If the flat rate system of charging had been fixed by law, the telephone systems throughout the state of New York would not have grown as they have grown, and that in New York city would not have reached its present enormous size, which places it in the proud position of being the largest telephone system in the world. It is fortunate for the public that the legislature refused to allow itself to be "rushed" into enacting a hasty and ill-considered law by an agitation conducted by persons who were very slightly acquainted with the subject they sought to have regulated.

It will be remembered, for example, that in the discussions on telephone rate bills at Albany allusion was frequently made to the development of telephony in Europe, and unfavorable comparisons were made between New York and European cities. Well, to-day, the Borough of Manhattan has more telephones than Berlin, a third more than London, half as many again as Paris, three times as many as Vienna, more, indeed, than the whole of Austria, more than the whole of Switzerland or Belgium or Holland. This great and growing popularity of the telephone in New York could not exist if the people were not on the whole well satisfied with the rates and the service, and it amply confirms the contention of the telephone companies that a real and widespread demand for legislation did not exist even in the days of the noisiest agitation.

It is interesting to look for a moment at the means by which the dissatisfaction at one time existing has been practically removed, and has resulted in the striking development referred to. The two main factors have been a thoroughly efficient service and the message rates. A wise and discerning management has spared no effort to keep the service up to the very top notch of efficiency and to develop the rate system to a point where the service is placed practically within the reach of all having a real use for it. In the plant of the New York telephone system every improvement making for efficiency has been adopted as soon as its value has been established. Much patient work has been devoted to training a staff which has for its motto the efficiency of the service, and which has the ability, the energy, and the application constantly to live up to that motto. The rates have been modified and reduced at various times, as experience was gained in their working and in the response of the public, until the minimum is now less than half the figure of the minimum rate in the first message rate schedule. Extensive reductions have been made in the rates for various special facilities and classes of service, and new subdivisions of the service have been introduced to meet various requirements. From the man who is in town one day a month and wants to use the service at a public telephone station in order to map out his day, up to the big firm or apartment house requiring a branch exchange with fifty or a hundred telephones under one roof, the wants of all are anticipated and catered to.

SOME NEW COHERER PHENOMENA.

BY F. CAMPANILE AND G. DI CIOMMO.

In an article contributed to the Italian journal, *L'Elettricista,* Signori Campanile and Di Ciommo describe some experiments of extraordinary interest undertaken to obtain information as to the nature of coherer action. A translation in abstract follows:

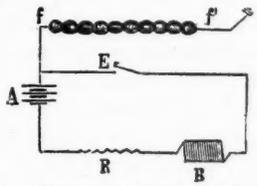


FIG. 1.—MERCURY GLOBULE COHERER.

There has been great discussion as to the mode of operation of a filings coherer, and the experiments of Vincentini upon the behavior of a discontinuous conductor subject to electric action, those of Arons with the observation of metallic powder under electrical action through the microscope, and those of Malagoli with photographic methods, show that the particles of a discontinuous conductor subjected to the action of electric waves when completely enveloped in a surrounding dielectric come into direct contact with one another. They also show that the breaking down of the resistance of the coherer produced by electric waves is accompanied by small sparks jumping from particle to particle of the metallic powder and sufficiently powerful to impress a photographic plate.

In the experiments of Vincentini on emulsions of mercury in olive oil or turpentine oil the electric action was due to sparks breaking through short distances in the emulsion or the coalescence of the globules of mercury themselves. The energizing spark was given by a four-plate Holtz machine able to give sparks 12 inches long and connected with a large battery of condensers.

We have been able to prove by simple experiments: (1) that the behavior of a mercury globule coherer subject to the action of extra current potentials and electric waves is analogous to that of the particles in an ordinary filings coherer under the same actions; (2) that a coherer becomes conducting along certain lines and not in the entirety of its mass.

A MERCURY GLOBULE COHERER IN VASELINE OIL.

The experments were conducted in the following manner: Upon a glass plate there was fastened with Canada balsam strips of glass in such manner as to make a long, narrow rectangular cell. At the extremities of this were attached two fine copper wires, amalgamated on the ends, and in the little cell was placed vaseline oil and a small quantity of mercury which was stirred up into globules with a metallic wire. This arrangement was put in circuit with a battery of accumulators, *A* (Fig. 1), a resistance *R* and a coil *B*. One of the two small wires *f* is connected with one point of the circuit as shown and the other left disconnected Breaking the circuit at *E*, the mercury globules reunite in a fine stream. The arrangement shown in Fig. 2 consists of a single cell of battery connected in circuit with a galvanometer *G*, a key and the coherer With the arrangement as shown the coherer introduces an enormous resistance into the circuit and the galvanometer needle does not deviate. Closing the key *T* the needle, of course deviates fully and remains in the position indicating a short circuit when the key is opened. If, instead of the single cell, a battery of ten or twelve accumulators is used, on opening the switch *T* the spherical globules can be seen to unite and spread themselves out into a continuous stream.

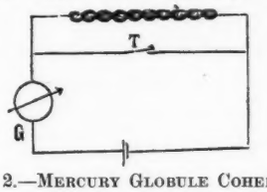


FIG. 2.—MERCURY GLOBULE COHERER.

By using a Righi oscillator worked by an induction coil and having the mercury coherer in circuit in the usual way with a battery and galvanometer, a single spark was found sufficient to cause cohering action. Under these conditions the drops do not seem to unite as before, but the galvanometer shows a diminution of resistance and when one side of the glass cell is removed it will be found that the end globules have connected themselves with the mercury film on the leading-in wires.

If the mercury is divided into a larger number of drops, more and larger sparks are required to exhibit the action. In these experiments the coherer was about six metres from the oscillator. At less distances a small Holtz machine with 12-inch disks and using its own condensers gave excellent results.

In a glass tube about one-quarter inch in diameter there were introduced numerous very fine globules of mercury suspended in vaseline oil. The tube was closed at its ends with small corks through which were led wires of amalgamated copper. This coherer, which is entirely analogous to the metallic powder coherer, diminshed enormously in resistance under the action of electric waves and when the tube was shaken resumed its former high resistance. Owing to the large number of globules and their small size it was not possible to observe the formation of connecting links between them.

From these experiments we are led to conclude that the phenomena of total or partial juncture of the parts of a discontinuous liquid conductor can be obtained under the action of extra current potentials and also through the waves radiated by a Righi oscillator. It also seems that these phenomena are entirely analogous to those of the metallic powder coherer and that the mode of operation of coherers is by the formation of minute sparks from part to part, *i. e.*, from filing to filing in the ordinary Branley pattern, and from drop to drop in the liquid type, these sparks perforating the intervening material and establishing bridges between the solid particles; in the case of liquid particles they cause the latter to run together and become fine streams of conducting metal.

MULTIPOLAR COHERERS.

Among the numerous studies and researches made upon coherers none has determined whether the diminution of resistance is general in all the mass of the coherer substance, or if it is limited to determinate lines (strings of particles), such as can be formed by the leaping sparks of Arons and Malagoli, or by better contact through the turning around of the filings or by the spreading out and coalescing of the globules in a liquid coherer.

In order to show that the conductivity does not augment in the entire mass a glass tube, such as is shown in Fig. 3, may be used. This is about three inches long, three-eighths inch in diameter and is filled with brass filings and closed at its two extremities with plugs. It is divided into equal parts by the points 1, 2, 3, 4 and 5, at which little pointed brass wires run through holes in the glass. These are connected to mercury cups as shown in the illustration. If the coherer becomes conducting by the formation of chains of particles between terminals 1 and 5, for example, then it does not follow that it will be conducting between other terminals unless these chains of particles include the entering wires of the latter. From numerous observations it was concluded by the use of this instrument that chains of conducting particles are actually formed and that the coherer does not become conducting in all its mass; that it may become conducting as a whole and still remain of high resistance from part to part, and that a coherer can become of low resistance in part without showing any diminution of resistance as a whole.

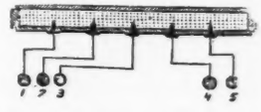


FIG. 3.—SECTIONAL COHERER.

SCIENCE BREVITIES

The Blackening of Incandescent Lamps—The cause of the deposits of carbon on the inner walls of incandescent lamps has long been a subject of speculation and many theories have been advanced to account for it. The hypothesis of slow evaporation of carbon, due to M. Moissan, is vitiated by the fact that the deposit does not depend upon the degree of exhaustion. Berliner's idea that gases occluded within the filament are expelled with great rapidity when it is lighted is negatived by the observation that the deposit is about the same in lamps continuously glowing and those often relighted. Herr J. Stark, writing in the *Elektrotechnische Zeitschrift,* attributes the disintegration of the carbon to leakage streams between the ends of the filament which traverse the rarefied gas of the bulb, as in a Crooke's tube. While these currents can be put in evidence by means of probes inserted in the bulb they also make themselves evident as a positive glow around the base of the filament. Where continuous currents are used the positive end of the carbon, that is, the cathode part, soon turns black and is the first to break. The internal currents vary in strength according to the potentials used.

Duration of the Electric Spark—MM. Abraham and Lemoine have been using their stroboscopic method for the study of the minute intervals which separate the phenomena of formation and disappearance of an electric spark. In a communication to the French Academy of Sciences they reached the conclusion that the total duration of the spark is less than four ten-millionths of a second and that the spark attains its maximum brightness in about one one-hundred-millionth of a second.

Fluorescent Screens—In some fluorescent screens used for Rœntgen ray work, notably those made of Sidot's zinc sulphide, a certain time effect is observed at each operation, says an *Electrician* abstract. The bones of the hand are not visible at once on the screen. They gradually separate out from the flesh. This effect is only partially due to a change in the radiation impinging upon the screen. We know that a "hard" tube gives more decided radiographs, and the effect might be attributed to the hardening of the tubes while in action. But, on the other hand, a gradual and distinct brightening of the screen is observed, which is quite independent of any change in the radiation and is unaccompanied by any change of color or of chemical constitution that could be discovered by any means at present available. J. Precht has studied the time effect both in sulphide and in platino-cyanide screens. He finds that the time required for a good development of the radioscopic picture is on the whole shortest at the highest discharge potentials. It varies from a few seconds to a minute. The most obvious explanation lies in an allotropic modification of the substance of the screen, as postulated by Becquerel for radium rays. But the author puts forward an emission hypothesis of Rœntgen rays.

A New Magneto-Optic Effect—A partial polarization of the light emitted by vacuum tubes under the influence of a magnetic field has been discovered by M. R. Dongier. It is best observed in the case of the red rays emitted by hydrogen under the spark discharge. With a magnetic field of 4,000 units acting at right angles to the axis of the tube, an ordinary spectroscope only shows a diminution in the intensity of the radiation. But a Savart polariscope reveals the fact that the radiation has become partially polarized. The light emitted in a plane normal to the axis of the tube differs according to its azimuth. The greatest proportion of polarized light is found in a direction normal to both the tube and the field. There are two such directions, and they again differ in optical properties among themselves. That direction shows the maximum of polarized light which is such that the observer can, by a right-handed rotation of 90 degrees, bring the vector representing the magnetic field into coincidence with the vector of the electric field inside the tube. The fringes observed can, in fact, be made to appear and disappear by commutating either the current or the field. A red glass should be used to intercept the other rays. Similar effects, though less well marked, are observed in nitrogen, carbonic acid, argon and chlorine, says one of Mr. Fournier d'Albe's abstracts.

Becquerel Rays—Professor F. T. Trouton, of Trinity College, Dublin, communicates the following interesting letter to *Nature:*

In view of the difficulties arising in supposing that the energy to produce the photographic, ionizing and phosphorescent screen effects with the "Becquerel Rays," continuously emanates from the active substance, I would suggest that the possibility should be kept in view of the real source of the energy being found in the things themselves in which these effects are manifested.

From this point of view the emanating influence would be looked upon rather in the light of lines of force than as a wave propagation; and, indeed, up to the present we have no conclusive evidence that the effects are those of waves.

The ionizing power is especially suggestive, and considered in connection with other known ionizing effects through molecular distances, may well be only the case of similar action taking place over greater distances, corresponding to centres of greater molecular mass, such as the atomic weights of those up to the present observed active substances possess. The effect would then be viewed as due to what might be called a Becquerel field of force, arising it may be from some strained condition of the ether directly accompanying the existence of material molecules, or through the intermediary action of molecular chains. In this connection, as well as on account of the magnetic deflection, it would be important to know if the action takes place through a really high vacuum.

From this view the active substance need not lose in power with time, and so long as fresh unused-up material to be acted upon is brought up there need be no cessation in the effects observed.

An observation of M. and Mme. Currie that a phosphorescent screen ceased to afford illumination after a time, although the active substance continued to affect fresh screens is in agreement with this, as well as their further observation that the exhausted screen after exposure to light is again capable of being affected. Thus some of the energy at least, if not all, is apparently to be attributed to the screen.

The effect, then, would be looked on as one of chance alignment or directive selection in a field of force; advantage, so to speak, being taken of suitable molecular movements according as they occur in the affected matter.

From this point of view there would be a close analogy with the action which takes place in a piece of soft iron in the field of a permanent magnet, the process of gradual orientation of the molecules in the iron, while it is occurring, corresponding to, say, the luminous stage in the phosphorescent screen. The final stage of magnetization corresponds to the exhausted condition of the screen.

If these suggested views were correct we might expect from the analogy that forces should exist between the acted-on substance and the source of the "Becquerel Rays."

ELECTRIC LIGHT IN PHOTO-MICROGRAPHY.

BY A. C. SCOTT.

It is a well-known fact that the arc light is very valuable to the photographer, as he may in many cases substitute it very profitably for sunlight.

It is a decided improvement on sunlight for copying photographs, steel engravings and the like, as with two focusing lamps a far more even distribution of light may be obtained on the object than can usually be had with sunlight. An exposure of a few seconds only is all that is required even with a slow plate (Carbutt's B), and in making negatives of flowers, oil paintings and other colored objects for optical projection in natural colors, this form of light is invaluable.

One of the most recent and perhaps effective ways in which it has been successfully employed in connection with photographic work, is in photo-micrography.

An automatic focusing arc lamp is placed in a nearly horizontal position (as shown in the illustration), so that the major part of the light given will be projected vertically upward, passing through a condensing lens, and the object to be photographed, thence to the sensitive plate.

The lamp gives excellent results when used on a 110-volt circuit with 20 amperes, giving in the position used, about 2,000 candle-power. The lamp with increased current might easily furnish 5,000 candle-power, or even more, but for work upon living organisms, magnified as high as 200 diameters, an exposure of one-fortieth of a second has given good results, as indicated by the illustration herewith presented. A suitable resistance is used in series with the lamp and the intensity thus controlled to suit the object being photographed and the exposure required.

In the work for which this lamp is used the light passes through the condensing lens and thence to the microscope stationed directly above. The object which is to be photographed, if a living specimen, is placed in a drop of water upon a piece of thin clear glass and the light turned on. The successful application of the light at this point involves the use of a specially arranged photographic shutter and view tube. This shutter has a total reflecting prism placed in such a position that no light can pass to the sensitive plate which is all the time exposed inside the camera bellows, but after passing through the microscope is turned upon a ground glass screen at the end of a conical view tube, which enables the operator easily to study the movements of the specimen. When it assumes the desired position, a pneumatic release allows a spring

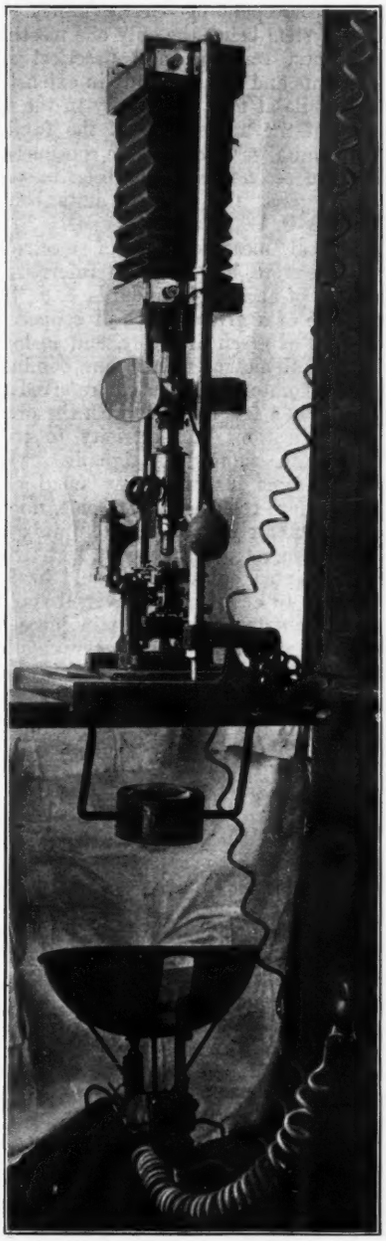


FIG. 1.—APPARATUS FOR PHOTO-MICROGRAPHY BY ELECTRIC LIGHT.

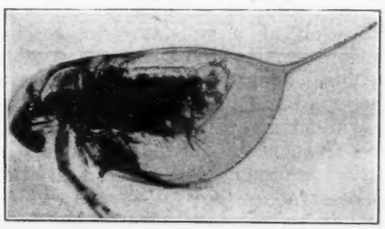


FIG. 2.—PHOTO-MICROGRAPH OF LIVING SPECIMEN. MAGNIFYING POWER, 200 DIAMETERS; EXPOSURE, 1/40 SECOND.

to instantly remove the prism from its first position and the light passes through an opening in the shutter to the plate.

The shutter is not yet perfected to the writer's satisfaction, but the illustration shows commendable results attained by a one-fortieth second exposure. There is no doubt that with improvement on the shutter and a higher power light, exposures of one one-hundredth of a second will give good negatives with the ordinary quick plates.

Sunlight has been used for this work, but is highly unsatisfactory, because it is far less intense when used with a mirror to reflect the light into the instrument than the arc light, thus necessitating too long an exposure for live specimens, and at the same time the defect of chromatic aberration is much more pronounced, which is another objectionable feature. The electric arc thus surpasses any form of illuminant that it is now possible to obtain for the study and photographic representation of these minute organisms.

American Institute of Electrical Engineers.

The 141st meeting was held in New York, March 28. In the absence of President Kennelly, Manager C. P. Steinmetz presided. A paper was presented by Mr. Joseph Sachs, on "The Evolution of Safe and Accurate Fuse Protective Devices." This is abstracted elsewhere in this issue of the ELECTRICAL REVIEW.

Resolutions of respect to the memory of the late S. Dana Greene, adopted by the council, were read by the secretary.

At the meeting of the council in the afternoon, fourteen associate members were elected. Professor F. W. Brady, of Mesilla Park, N. M., was transferred to full membership.

The following nominees were selected by council for the annual election, May 15:

For president, Carl Hering; for vice-presidents, Gano S. Dunn, Arthur V. Abbott, W. L. B. Emmet; for managers, W. B. Barstow, Calvin W. Rice, C. T. Hutchinson, R. D. Mershon; for treasurer, G. A. Hamilton; for secretary, R. W. Pope.

Dr. M. I. Pupin was appointed a manager to serve during the unexpired term of the late S. Dana Greene.

The South Magnetic Pole Located?

The exploring steamer Southern Cross, bearing C. E. Borchgrevink and the survivors of the South Polar Expedition, fitted out in 1898 by Sir George Newnes, of London, arrived at Campbell Town, near Bluff Harbor, New Zealand, on April 1. Mr. Borchgrevink reports that the magnetic pole has been located, says a press cable despatch from Wellington.

ELECTRICAL STANDARDS.*

THE FACILITIES AFFORDED BY THE OFFICE OF STANDARD WEIGHTS AND MEASURES FOR THE VERIFICATION OF ELECTRICAL STANDARDS AND ELECTRICAL MEASURING APPARATUS.

BY FRANK A. WOLFF, JR.

The need of adequate facilities for the official verification of standards and measuring apparatus of all kinds, has long been recognized by American physicists. The Office of Weights and Measures, with its small force, modest equipment and insufficient appropriations, has endeavored to meet any demands imposed upon it within the limits thus set.

The object of this article is to describe what has thus far been accomplished along electrical lines, and in this connection a brief history of the units of reference may not be considered out of place.

The origin of standards of quantity and value dates back as far as the earliest historical records. The transition from the crude measures of antiquity to the systems meeting present requirements has, however been exceedingly slow, although the growth of commercial intercourse gradually led to the introduction of more precise standards.

The requirements of accuracy were, nevertheless, quite modest until physics began to emerge from its qualitative stage to assume the dignity of an exact science.

The number and complexity of physical quantities at first led to the adoption of more or less arbitrary standards of reference, often based on the physical properties of some definite substance, *e. g.,* the calorie, and as long as the relations between physical quantities remained obscure, such relative standards sufficed. With the development of the science came the recognition of the desirability of a consistent system of units, which was strongly brought to the front, when it became necessary to measure magnetic quantities.

The happy solution of this problem suggested by Gauss and extended to the measurement of electrical and electro-magnetic quantities by Weber, constituted a great advance in the science of Metrology, the units being defined in terms of the mechanical actions to which they give rise. Since all mechanical units can be expressed in terms of three independent fundamental units, such as those of length, mass and time, the magnetic and electrical units of Gauss and Weber are thus expressible in terms of the same fundamental units and are therefore entirely independent of the physical properties of arbitrarily chosen substances. Hence they are called absolute units, their magnitudes depending solely on the choice of the fundamental units.

The units of length and mass selected were usually multiples or sub-multiples of the corresponding metric units, the metric system being the only one meeting the highest scientific and practical requirements and being already in extensive use. While at first uniformity in the selection of the magnitudes of the fundamental units was lacking, the centimeter, gram and second have now been universally adopted, the derived units being known as C. G. S. units.

Practical measurements of electrical resistance were, however, first referred to a variety of arbitrary standards, *e. g.,* the resistance of a given length of copper or iron wire of given diameter, and so long as electrical measurements were confined to the laboratory, the length referred to was usually a few feet, but with the practical applications of electricity to telegraphy and submarine signaling, this length became inconveniently small and was therefore replaced by fathoms, miles, etc. Fortunately none of these units ever gained general acceptance. In 1848, Jacobi pointed out that it would be far preferable to adopt as a universal standard, the resistance of a certain piece of wire, copies *having the same resistance* being easily constructed.

Jacobi carried this suggestion into practice by sending a piece of copper wire, since known as 'Jacobi's Etalon' to various physicists for that purpose.

In 1860 Werner von Siemens proposed as a standard of resistance, the resistance, at 0 degrees C., of a column of mercury, 1 square millimetre in cross section and 100 centimetres in length.

In 1861 a committee, composed of the most eminent English physicists was appointed by the British Association to consider the question of Standards of Electrical Resistance. Correspondence was opened with the leading foreign physicists and various special investigations of the problems, with which the committee was confronted, were undertaken by its members.

The first question settled was that the unit of resistance should be defined as a multiple by an integral power of 10 of the unit of Weber's absolute system, and that the unit chosen should be of a convenient magnitude. Accordingly, a unit equivalent to 10^9 C. G. S. units was adopted.

This definition fixed the unit, but the evaluation of a resistance in absolute measure requires the construction of especially designed apparatus, having usually a limited range of usefulness; the determination of instrumental constants most frequently involving tedious mathematical approximations, and in addition, the observations have to be made with the greatest precision. On the other hand, relative measurements require simpler apparatus and less skill in manipulation, besides being, in most cases, far more accurate than absolute measurements. The construction of material standards adjusted to the specified resistance, determined once for all by a series of absolute measurements was therefore decided upon. Investigations were made to determine whether the absolute unit of resistance could be accurately defined in terms of the resistance of a definite portion of a definite substance. Pure metals in the solid and liquid state and alloys were studied with this end in view. On account of the excessive influence on the resistance produced by small quantities of impurities in metals and by small variations in the composition of alloys and on account of the additional difficulty of procuring chemically pure materials, the choice was greatly limited. Moreover solids had to be rejected on account of the marked effect of physical changes produced by drawing, bending, annealing, etc.

Mercury, already recommended by Siemens, was therefore the only material to be further considered. Even this material was rejected, owing to large differences found to exist between coils, supposedly adjusted to agree with different German mercury standards, and the mercury standards constructed by members of the committee.

Having abandoned the above propositions, the alternative remained of constructing material standards adjusted with reference to the absolute unit.

A number of new alloys, in addition to many already in use, were made and investigated. An alloy of two parts by weight of silver to one part by weight of platinum was finally selected as best meeting all requirements. A special form of resistance standard was also adopted.

In 1863 and 1864, the values of certain coils were determined in absolute units by one of the methods proposed by Weber and from these measurements the B. A. unit was derived. A number of copies were issued gratis by the association and in addition arrangements were made to furnish others at a moderate price. The B. A. unit soon gained universal acceptance in the English speaking countries, while the Siemens unit still retained its supremacy on the continent.

In 1878, it was shown by Professor Rowland that the B. A. unit differed from its assumed value by more than one per cent, and soon after, this difference was substantiated by a number of other investigators.

In 1881 a call was issued, in connection with the first Paris electrical exhibition, for an international electrical congress for the purpose of adopting definitions of the electrical units to serve as a basis for legislative enactments. Numerous mercury standards had in the meantime been constructed and had been found to agree most satisfactorily with one another; moreover, the results of a considerable proportion of the absolute determinations made had been referred, directly or indirectly, to the Siemens unit. In view of this, the Paris Congress passed a resolution recommending that all absolute determinations in the future be expressed as the resistance of a column of mercury of stated length, one square millimetre in cross section at the temperature of melting ice, and that the C. G. S. electro-magnetic system of units be adopted. The de-

* From *Science.*

sirability of making new determinations of the ohm was urged.

Three years later the congress reassembled at Paris and adopted 106 centimetres as the length of the specified column of mercury, individual results still differing by as much as —.5 per cent. The unit of resistance thus defined was called the legal ohm, but while it was never legalized anywhere, it nevertheless came into extensive use, especially in England and in America.

Absolute methods were gradually improved, sources of error were pointed out, and eliminated as far as possible and accordingly the results of absolute determinations, made by the most radically different methods became more concordant.

The International Electrical Congress (which met in Chicago in 1893), through its chamber of Delegates, officially representing all the leading governments, there adopted, as the unit of resistance, the mean of all the best determinations, the resistance at 0 degrees centigrade of a column of mercury 106.3 centimetres in length and of uniform cross section having a mass of 14.4521 grammes (equivalent to a cross-section of one square millimetre, the density of mercury being assumed to be 13.5956). The unit of resistance and the other electrical units defined by the International Congress were legalized in the United States by Act of Congress in 1894, and have also been legalized in the other countries represented.

It was generally supposed that the various governments would sooner or later take up the construction of mercury standards as called for in the definition since each had already been provided by the International Bureau of Weights and Measures with the fundamental standards of mass and length.

The Imperial Physico-Technical Reichsanstalt in Berlin has already begun this task with its characteristic thoroughness. Two one-ohm mercurial standards were constructed, and later, a third, together with a one-half and a two-ohm tube. Widely different cross-sections were purposely selected to avoid possible sources of error. The calibration and intercomparison of these standards leave almost nothing to be desired, measurements made by two different methods, both yielding the same results within the limits of experimental error.

Twelve mercury copies were also constructed; these, together with seven working standards of manganin wire, periodically referred to the primary standards, complete the list.

In England, on the other hand, the B. A. coils have still been retained as primary standards. The legal ohm was defined in that country by the relation, one Siemens unit = .9540 B. A. units, and later the international ohm was defined by the relation, one Siemens unit = .95351 B. A. units. According to a comparison made several years ago, one Siemens unit, as derived from the Reichsanstalt standards, is equal to .95341 B. A. units, indicating a change in the coils themselves, or in their assumed relation to the Siemens unit or in both.

Matters have been still further complicated in England by the legalization of the resistance of a coil marked "Board of Trade Standard, verified 1894," and adjusted with reference to the Cambridge standards, as the unit of resistance.

A still more radical suggestion was made in that country several years ago, by Professor A. Viriamu Jones and Professor W. E. Ayrton, that each government adopt a Lorenz apparatus from which to derive by absolute measurements the unit of resistance. The practical substitution of an absolute method with its disadvantages as pointed out above, for a purely relative one seems to be taking a step, or, indeed, several steps backward, but may be taken as indicating the lack of confidence in the permanency of the B. A. coils.

After the legalization of the International Electrical Units it became the imperative duty of our government to provide facilities for the official verification of electrical standards and electrical measuring apparatus, especially in view of the continually increasing importance of the applications of electrical energy to the industrial arts. This function obviously devolved upon the Office of Standard Weights and Measures, already equipped for the verification of standards of length, mass, capacity, etc.

Owing, however, to the limited force and to the still more limited appropriations available for the purchase of apparatus, practically nothing could be done until July 1, 1897, when the appointment of a verifier was authorized, but, unfortunately, progress has frequently been interrupted for long periods by the pressure of routine work.

It was determined from the outset that it should be the aim of the Office to provide facilities for measurements to any degree of accuracy likely to be set even by the most exacting demands of modern science. The first steps taken by the Office consisted in working out a general plan and providing the most needed apparatus and facilities.

STANDARDS OF RESISTANCE.

To avoid the delay which would naturally arise from the construction of primary mercury standards, it was decided to refer all measurements of electrical resistance to the mean value of a number of wire coils, known in terms of the best existing mercury standards. The general excellence of coils of the Reichsanstalt type, the extremely small temperature coefficients, and the thermo-electro-motive power with respect to copper of manganin and the permanency of coils of that material as shown by long continued observations at the Reichsanstalt, decided in favor of standards of the above description.

Four unit coils were purchased and were standardized at the Reichsanstalt where they were kept under observation for about one month during which period they decreased in value by about .0015 per cent. This, according to the maker, is the normal behavior of the material which undergoes, after the artificial aging, a small decrease in resistance followed by a slow increase. In addition to these coils the Office possesses two other coils of the same type purchased several years ago. Periodic intercomparisons between the old coils and the new ones will be made so that any relative changes will be made manifest, the two hardly having the same rate of change. Two new manganin coils have been ordered and are also to be referred to the German standards. On their receipt, they will furnish us positive evidence in regard to any changes which may have taken place in the preliminary standards adopted. The approximate corrections at any time can then be determined by simple interpolation.

To fix this standard, the construction of a number of mercury copies will also be taken up. The construction of primary mercury standards, which is of fundamental importance, not only from a scientific standpoint but also on account of the legal questions which will surely arise, will be undertaken as soon as time permits.

The Office has acquired in addition to the unit coils, standards of the following denominations:

1	2	ohm
1	5	"
4	10	"
4	100	"
3	1,000	"
2	10,000	"
2	100,000	"
3	0.1	"
3	0.01	"
3	0.001	"
3	0.0001	"

The temperature coefficients of these coils were first carefully determined, then the coils of the same denomination were intercompared and the observations reduced to differences at 20 degrees centigrade.

The next step consisted in determining the resistance of the multiples and submultiples in terms of the unit. Thus, two unit coils placed in series by means of a connecting link of known resistance were compared with the two-ohm coil. The five and 10-ohm coils were similarly evaluated in terms of the unit. From the known ratio of a 10-ohm coil to one of the units, the step can be made to the 100-ohm coils by means of a second 10-ohm coil also known in terms of the unit. Similarly the values of the coils of still higher value were determined and those of the sub-multiples of the unit, by a slightly modified method.

(To be concluded.)

A New Electromobile Factory.

A large manufacturer of electromobiles will be an Indianapolis concern, incorporated under the laws of Indiana, headed by Mr. L. S. Dow, late of the American Bicycle Company. This firm is just about completing their first building, which is 75 feet by 350 feet, three stories high. They have already placed a large order for storage batteries with Sipe & Sigler, of Cleveland, Ohio. Their product will be chiefly light pleasure carriages and very light delivery wagons, for both of which there is an unlimited demand.

Electromobiles in Central Park, New York City.

Through the courtesy of Mr. Willis Holly, secretary of the Park Board of New York city, the ELECTRICAL REVIEW is able to present herewith a complete list of permits issued by the Park Board to residents of New York city who own electromobiles and who are thereunder allowed to drive their vehicles in Central Park.

The following very interesting letter from Mr. Holly has also been received:

TO THE EDITOR OF ELECTRICAL REVIEW:

Pursuant to your request, I enclose herewith a list of the automobile permits issued for Central Park.

Those numbered from 1 to 26, with the exception of No. 9 (which was revoked) and No. 15, are for open pleasure carriages with electrical motors. Permit No. 15 was issued for a motor cycle as an experiment. It is a gasoline motor, and is the only vehicle other than those with electrical motors for which a permit has been granted. Permits "A," "B" and "C" are for private broughams with electrical motors. The rules governing the issuance of permits thus far restrict them to electrical open pleasure carriages or private closed carriages. The admission of gasoline or steam-propelled vehicles is not yet considered advisable, the objections from a park standpoint being on account of their noise, on account of the smell of gasoline, and on account of the visible exhaust of steam.

It might be of further interest to add that the officials of the Park Department have by constant inquiry endeavored to get an intelligent measure of the effect upon other driving caused by the granting of permits to automobile drivers. I regret to say thus far no reports that are of value have been received. Whether it is due to the fact that since November 13, 1899, the weather may have been considered largely unfavorable, or whether it is that the hills in the parks use up too much current. I do not know. The fact remains that the use of the drives under these permits has been so light that the usual answer, when a horseman is asked about the automobiles, is in the words, "We never see them."

WILLIS HOLLY,
Secretary Park Board.

NEW YORK, March 31.

AUTOMOBILE PERMITS.

1. R. A. C. Smith, November 13, 1899.
2. J. M. Hill, November 27, 1899.
3. Curtis P. Brady, November 27, 1899.
4. Albert C. Bostwick, November 29, 1899.
5. Whitney Lyon, December 4, 1899.
6. Jefferson Seligman, December 9, 1899.
7. Martin Maloney, December 9, 1899.
8. James B. Brady, December 12, 1899.
9. Isaac L. Rice, December 12, 1899; revoked, December 15, 1899.
10. J. J. Astor, December 14, 1899.
11. W. E. Busby, December 16, 1899.
12. Theo. C. Marceau, December 20, 1899.
13. A. R. Frank, December 20, 1899.
14. John Post, Jr., December 20, 1899.
15. Chas. A. Dugro, December 22, 1899.
16. A. E. Chandler, December 22, 1899.
17. Miss Florence E. Woods, December 30, 1899.
18. C. T. Yerkes, January 9, 1900.
19. Walter S. Martien, January 18, 1900.
20. Dr. Wm. T. Jenkins, January 24, 1900.
21. A. G. Miles, January 24, 1900.
22. James Joyce, Jr., January 25, 1900.
23. M. Sergey Friede, February 3, 1900.
24. Augustus Post, February 3, 1900.
25. F. S. Kinney, February 3, 1900.
26. Miss Beatrice Kinney, February 7, 1900.

"A" R. A. C. Smith, February 26, 1900.
"B" Dr. W. B. James, March 5, 1900.
"C" Jefferson Seligman, March 12, 1900.

The Automobile Club of America.

The Automobile Club of America, whose certificate of incorporation was filed last August, is the first club of the kind formed in the United States and is now in a flourishing condition. Its membership includes 165 active members and 16 associate members. The club has permanent headquarters at the Waldorf-Astoria, New York city, and contemplates an active season during the coming Spring and Summer. As has already been announced, an automobile show will be held, under the auspices of the club, at Madison Square Garden, next Fall.

Mr. George F. Chamberlin, the vice-president of the club, is acting president owing to the fact that General Avery D. Andrews, who held the office for a short time, was obliged to resign on account of the press of other work. Captain Homer W. Hedge, a well-known military man and an enthusiastic automobilist, is secretary, and Mr. Walter E. Frew is treasurer. The club has recently appointed a technical committee of which Mr. C. J. Field and Professor R. H. Thurston are members.

The objects of the club are the promotion of a social organization composed of persons owning self-propelled pleasure vehicles for private or personal use; to record the experiences of members and others using automobiles; to promote original investigation in the development of motor carriages; to secure rational legislation and proper rules governing the use of automobiles in city and country; to maintain the rights of owners of all forms of self-propelled pleasure vehicles; to encourage the development of the automobile and to promote the construction and maintenance of good roads and the improvement of existing highways.

The membership is composed of four classes—honorary, life, active and associate. The active membership is limited to 400, and the annual dues are $50. At present there is no initiation fee. Associate members are those persons living more than 50 miles from New York city, and their dues are $25 per year. The constitution provides that all the officers of the club shall be owners of automobiles.

A National Highway for Automobiles.

The Automobile Club of America held its first formal dinner at the Waldorf-Astoria Hotel, in New York city, on the evening of April 2. The dinner was in honor of Major-General Nelson A. Miles and his associates who form a special temporary commission to report upon a plan for the construction of a transcontinental highway for automobiles and other vehicles. The commission is composed of the following gentlemen: Major-General Nelson A. Miles, chairman; Francis E. Stanley, of Newton, Mass; Colonel Peter Michie, professor at the United States Military Academy, West Point; Colonel Richard L. Hoxie, of the Corps of Engineers, United States Army; Colonel Samuel E. Tillman, professor at the United States Military Academy, West Point, and Colonel John Jacob Astor.

In the afternoon, at a brief business session of the commission at the rooms of the Automobile Club, at the Waldorf-Astoria, resolutions were adopted, indicating that the most feasible route for a national highway from the Atlantic to the Pacific was between the fortieth and forty-second parallels of latitude, crossing twenty-five states and territories, and that Congress be petitioned to authorize the preliminary surveys.

The resolutions were read at the dinner by Colonel A. A. Pope. General Miles spoke briefly and mentioned the benefits to be derived by farmers and the driving public generally as well as automobilists. Ex-Mayor William L. Strong advocated the idea of beginning to build at once a road from New York to Buffalo "that you could play marbles on." Mr. Isaac B. Potter, formerly president of the L. A. W., also spoke, and Colonel John Jacob Astor expressed the hope that the members of the Automobile Club of America would soon be riding over the transcontinental highway.

One Way to Run an Electromobile.

A wealthy resident of Chicago rode to the city hall yesterday from his residence. He went to take the examination for automobile drivers.

City Electrician Edward B. Ellicott conducted the quiz as follows:

"What parts of the automobile need taking care of and cleaning more than any other?"

"I leave the inspection and cleaning of my carriages to my stableman."

"What would you do if your automobile broke down?"

"I would call a cab and go home."

A license was granted.—*Chicago Times-Herald.*

THE OELWEIN SHOPS.

THE FINE ELECTRIC POWER DISTRIBUTION SYSTEM OF A MODEL RAILWAY REPAIR AND MACHINE SHOP.

Oelwein, Iowa, is the centre from which radiate the three main lines of the "Maple Leaf Route" and at this central point, which is the natural location of the repair shops of this system, the Chicago Great Western Railway has recently completed an extensive installation for the building of part and the repair of all of its rolling stock. In the laying out of these new shops the keynotes have been the economical handling of material and the concentration of power generating machinery. The designers were conversant with the needs of shops for railroad work, and the extent to which they have used electricity in carrying out their plans lends considerable interest to this installation.

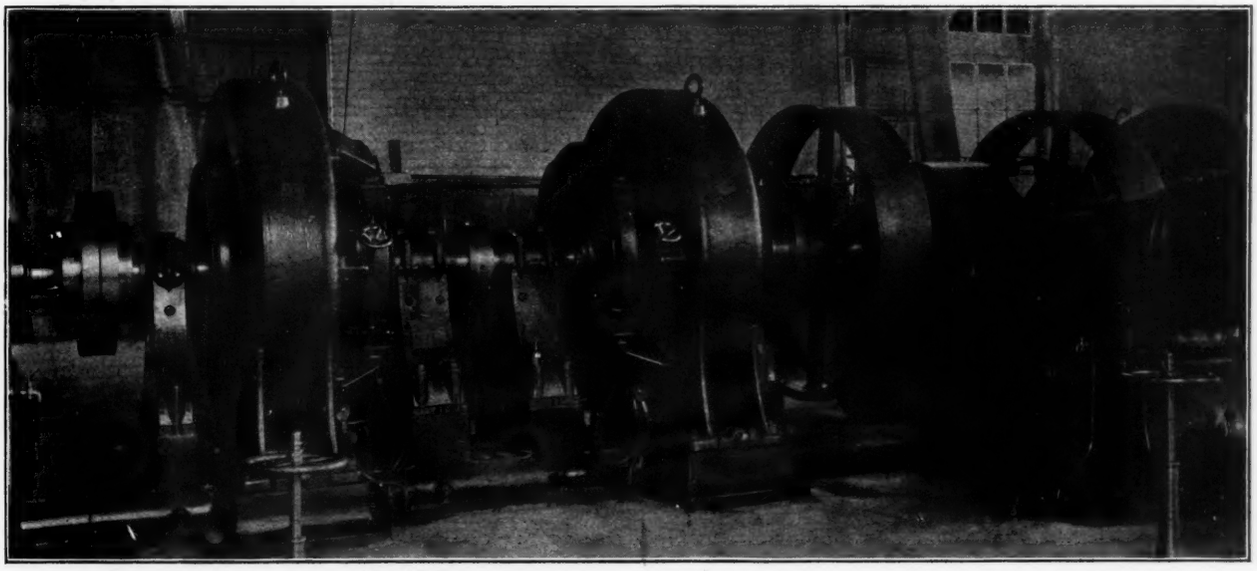


FIG. 1.—GENERATORS IN THE ELECTRIC POWER PLANT AT THE OELWEIN, IA., RAILROAD SHOPS.

The economical transfer of raw material and finished product has been accomplished partly by arranging the buildings parallel to a transfer table, which is capable of carrying the largest coach and the heaviest locomotives. Further than this an electric crane serves the machine shop, an electric elevator is operated in the store house and an electric derrick is placed convenient for handling material between two loading or unloading tracks, the store house platform, the wheel yard, or the transfer table.

Concentration has been secured by having one central station which furnishes heat, light, water and power: heat to the passenger station, freight house, engine house and shops; light to the yards, passenger station, freight house, ice house, engine house, coaling station and shops; water for all purposes and power for engine house, ice house, coaling station and shops.

The shops proper consist of nine buildings, the character of the construction in each case being governed by the use of the building. The machine shop is 720 feet long by 90 feet wide, and has a capacity of 20 locomotives and six coaches. This building also contains the offices, store rooms, machine shop, air brake repair shop, and boiler shop, instruction room, tinshops, upholstering and varnishing rooms. This building is of brick, with an abundant window space, and is spanned by a steel truss, the roof consisting of plank and felt covered with Ludowici tile. A similar construction was adopted for the paint shop, but in the wheel shop, oil house, blacksmith shop and power house, the Ludowici tiles are laid directly on the steel frame, glass tile being used where light from the roof was required. Where the contents of the building were to be inflammable, as in the wood mill, the lumber store room and freight car shop, heavy timber construction was used in preference to steel. An employees building is provided with lockers, baths, closets and wash basins on the main floor, and with a library and club room above.

The general plan of the grounds and buildings is such that the greatest distance between any two parts of the shop is 750 feet; that provision is allowed for extension; that by means of a single transfer table crew all material can be moved expeditiously between departments; that the cars to be repaired are taken to the men, tools and material; that any completed car or locomotive can be moved without disturbing the unfinished work upon the adjoining tracks, and that all yard switches are controlled from one switch cabin.

The new transfer table is operated by a General Electric Company's No. 52 motor, taking current by means of two trolley poles from wires suspended by span construction over the centre of the tracks. The transfer table was made by the Industrial works, at Bay City, Mich.

The electric derrick, which has a lifting capacity of five tons, is fitted with a 50-foot steel boom, which is raised and swung from a cab supported on the mast and swinging with it. The derrick was built by the American Hoist and Derrick Company, of St. Paul, Minn.

In the main shop, a 15-ton traveling crane, with a span of 60 feet and a speed of 400 feet per minute, covers all the erecting part of the shop. This crane is used as a carrier of material to and from the equipment being repaired, and it can also deliver material to any part of the balcony extending down one side of the locomotive shops, thus providing a secondary line of traffic similar to the main transfer table, and extending the full length of the shop. A dummy crane of 65 tons capacity, with hoisting motors only, is provided for heavier work. Both cranes were furnished by Manning, Maxwell & Moore.

Thirty motors, ranging in size from two to sixty horse-power, are used for various purposes throughout the shop buildings.

In the main building, the machine tools are grouped with reference to the natural movement of material from raw to finished state. There is one line of line-shafting in two sections, each of about 75 feet in length, each section being driven by a 20 horse-power motor hung from the girders above. These two sections of shafting can be connected by an Arnold magnetic clutch, so that both may be driven by either motor. Individual motors were not adopted on account of the extra first cost of the motor equipment.

The boiler shop is supplied with power from a single section of shafting, similar to that in the machine shop, and driven by a 20 horse-power motor. In the wood mill, where the bulk of the power is used, all the motors are supported above the purlines of the Howe trusses, leaving the

space underneath free for shafting and belts. Each of the five shafts in this mill are driven by a separate motor. In this wood mill, the Allington & Curtis Company have installed a system of collectors which remove the dust and shavings from all the machines and feed it to the boilers in the power house.

The blacksmith shop is equipped with down draft forges, with Sturtevant exhaust and blower, driven by a 25 horse-power motor and connected by underground piping. A 10 horse-power motor in this department operates a small steam hammer, a punch and shear and a forging machine.

Other motors drive the shafting in the wheel shop, the ventilating fan in the lavatory, the hoist in the ice house and the pump under the water tank. The use of motors in the yard operations will be extended by equipping the turntable, the coal chute and by the electrical operation of other labor-saving devices.

The power house has a basement which connects by tunnels with the different shop buildings. These tunnels are used for the heating, compressed air, live steam and water pipes, and for the electric wires of the power and lighting circuits.

The entire equipment for making and distributing heat, light, power and water to the various buildings and yards was furnished by the Arnold Electric Power Station Company, of Chicago, under a guarantee of certain results that could be obtained with standard machinery, operated under normal conditions. This contract is interesting as indicating how the engineers arrived at a comprehensive result by making one contractor responsible for the operation and economy of the entire installation.

The general provisions of the contract indicate so clearly the extent and functions of the power plant equipment that their publication will be a more valuable contribution to engineering literature than the usual hackneyed description of the various parts.

These guarantee clauses are as follows:

The contractor shall guarantee that the plant he installs shall consist of apparatus of design and capacity that will obtain the following results, when operated under normal conditions, and that it shall be free from mechanical and structural defects.

1. The generating of steam for all the purposes specified with an economy, when operated at 80 per cent of the greatest possible demand, equal to the evaporation of eight pounds of water into steam containing not more than three per cent moisture, from and at 212 degrees Fahrenheit for each pound of lump coal consumed, containing 11,500 Board of Trade units, or its equivalent, with a draught of six-tenths of an inch at the base of the stack. The boilers shall be divided so that the failure of any one shall not decrease the maximum output more than thirty-three and one third per cent.

2. The heating of the buildings as specified hereafter, utilizing for this purpose the exhaust steam from all sources (purified through grease extractors) and returning all water of condensation to the boilers, which, with all additional water necessary, shall be at a temperature of not less than 200 degrees Fahrenheit when entering the boilers.

3. The generating of 300 kilowatts of electrical energy delivered at the switchboard for 18 hours per day, with provision for an increase of 375 kilowatts for two hours and 450 kilowatts for one hour.

The generators shall be in three units of equal size and the engines and connections shall be so arranged that the failure of one engine or one generator will not reduce the maximum output more than thirty-three and one-third per cent.

This electrical energy shall be generated with a total consumption of steam per kilowatt-hour (including leakage, condensation and steam for back pressure and feed pumps) as follows:

When one generator is operated at full load, 48 pounds; at three-quarters load, 58 pounds; at one-half load, 80 pounds.

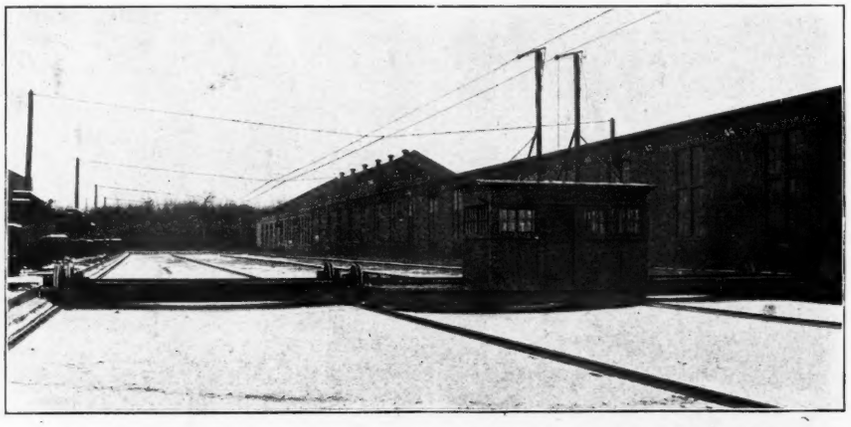


FIG. 2.—ELECTRIC TRANSFER TABLE AT THE OELWEIN, IA., RAILROAD SHOPS.

When two generators are operated by large engine at full load, 44 pounds; at three-quarters load, 54 pounds; at one-half load, 72 pounds.

4. The measuring and controlling of the current by proper instruments arranged to show voltage and current from each generator, and prevent automatically its overload; to distribute it by switches to various circuits; to so arrange its distribution that the lights may be least affected by varying loads; to give proper information as to the probable duration of loads, and to convey the current to the lights and motors at an average loss not to exceed five per cent.

5. The converting of a part of the electrical energy into motive power through motors that will furnish to their shaft the horse-power specified for 18 hours per day, with an average efficiency for all sizes not less than 88 per cent with full load, 86 per cent three-quarters load, 83 per cent one-half load. The motors to be capable of carrying 25 per cent overload for two hours without injury; and in starting to be able to develop a power 50 per cent greater than rated capacity, and shall be provided with automatic cutouts that limit their overload to this amount.

6. The installing of electric lighting mains for 51 1,200 candle-power arcs, and 600 16 candle-power, 220-volt incandescent lamps, or their equal, located as specified hereafter.

7. The compressing of 500 cubic feet of free air per minute, and delivered to the mains at a pressure of 100 pounds and distributing it as specified hereafter.

8. The pumping of 10,000 gallons per hour from the well in power house into a 100,000-gallon tank to be located on the 80-foot tower provided therefor, and its distribution through the water-mains as specified hereafter.

The providing of a fire pump that will fulfill the requirements of the National Board of Fire Underwriters, and capable of delivering 1,000 gallons per minute, with 100 pounds pressure in the mains when there is a discharge through four lines of 500 feet each of 2½-inch hose and 1½-inch smooth nozzles.

Providing an electrically-driven pump in round house, capable of maintaining a pressure of 100 pounds with a discharge through 50 feet of 2½-inch hose and ⅝-inch nozzle.

9. To provide a drying apparatus for lumber kiln capable of drying 30,000 feet of lumber at a time.

In connection with this abstract from the specifications, the conditions which determined the provisions are worthy of note. The low cost of fuel on account of the use of locomotive coal and the burning of the wood mill refuse, limited the requirements in regard to the efficiency performance of the boilers and engines, while the fact that the exhaust steam could be utilized for heating purposes for five months of the year, determined that the extra cost of condensers and water cooling equipment would not be a good investment.

Electricity was naturally selected as the power transmitting agency for most of the work, and the 220-volt direct current was adopted as it allowed the use of standard lamps and apparatus, while the copper required for the distributing mains at this potential did not require too great an original outlay. For some purposes, such as the pneumatic tools and air lifts, compressed air is desirable, which accounts for the air compressor system.

The various makes of apparatus selected to carry out the provisions of the contract were as follows:

Three high pressure water tube boilers, made by the Stirling Company, were installed.

The heating of the main building (except store), the freight car shop, wood mill and lumber store, is accomplished by the Sturtevant fan system. All other buildings are heated by direct radiation. For the fan system there are two 25 horse-power motors operating blowers in the machine shop. These motors are connected so that they can be run in series when the weather is mild, thus cutting the speed down and materially reducing the amount of air moved and the power required. A similar arrangement is carried out in the electrical connections of the two 10 horse-power blower motors in the wood mill and freight car shop. The vacuum system of the Western Paul Company has been installed in order to remove the back pressure from the engine during the heating period.

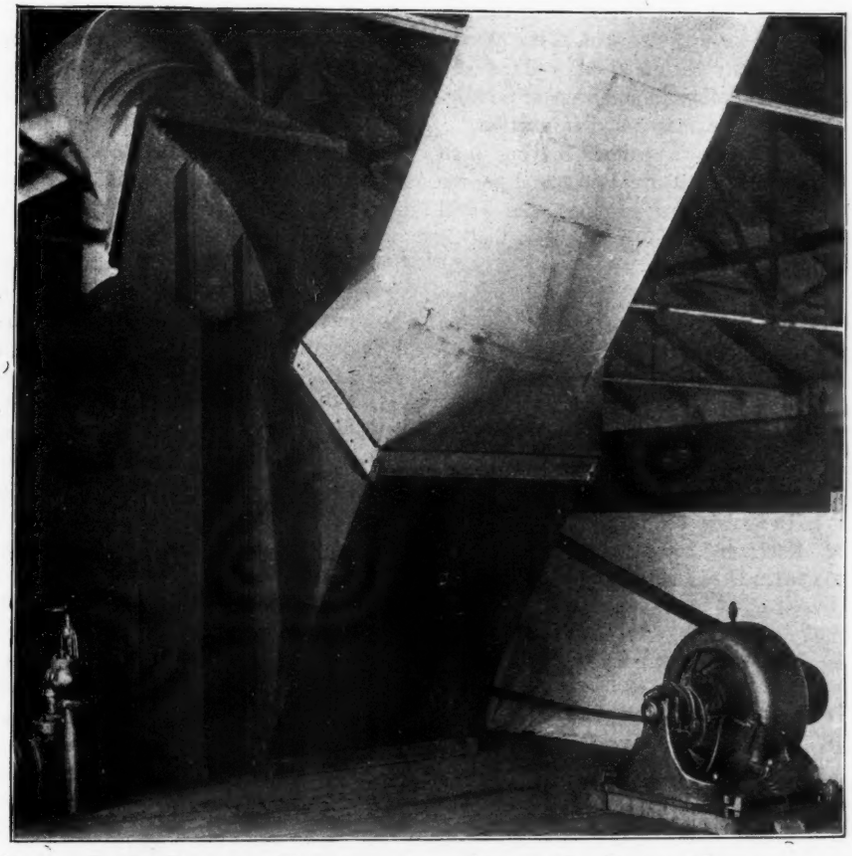


FIG. 3.—ELECTRICAL VENTILATOR IN THE OELWEIN, IA., RAILROAD SHOPS.

The three 100 kilowatt generators and all the motors, with the exception of those on the crane and transfer table, were furnished by the Crocker-Wheeler Company, of Ampere, N. J.

The two engines are tandem compound, of the Ideal type, running at 250 revolutions per minute, and were built by A. L. Ide & Son, of Springfield, Ill. One engine has an economical capacity sufficient to drive two of the generators, while the other engine is one-half this size. The latter engine, however, is provided with an auxiliary steam connection which allows live steam to be introduced into the low pressure cylinder through a reducing valve, thus furnishing a means of carrying an overload of 100 per cent in case of emergency, all the parts having been designed for this extra strain.

That part of the guarantee which specifies that the failure of one engine or generator will not reduce the maximum output more than thirty-three and one-third per cent was fulfilled by connecting the engines and generators by means of the Arnold system. This system mounts the generators upon hollow quills and provides a solid interconnecting shaft in such a way that each generator can be operated by more than one engine. Thus if the large engine should become crippled the small engine could still operate two generators by taking advantage of the extra steam connection already described, while if any one of the generators or the small engine should become disabled the large engine would still be in position to drive the other two generators. This arrangement secures the specified reliability without an excessive investment in reserve machinery, and without requiring floor space, foundations and piping for an extra independent unit.

The switchboard is of highly polished enameled slate. As usual, each generator is provided with a panel and an extra feeder panel is added for the circuit switches, the three upper switches controlling the power mains and the two lower double-pole switches connecting the lighting circuits. The single-pole switches on the feeder panel are for the purpose of connecting the power and light bus-bars so that both classes of service can be operated from one generator if desired. A unique feature of this board is that it has but three bus-bars, a common negative bar doing duty for both the power and the lights.

The air compressor was furnished by the Norwalk Iron Works, of South Norwalk, Ct., and the deep-well pump by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

The piping for the heating system was put in place by George Morton, of St. Paul, who was sub-contractor for the heating. The electrical construction work was done by the Mutual Electric Company, of Chicago.

The ELECTRICAL REVIEW is under obligations for data relating to this plant to the following named gentlemen: Mr. Tracy Lyon, general superintendent, Chicago Great Western Railway; Mr. C. A. Reed, the architect of the shops, and Mr. B. J. Arnold, of the Arnold Electric Power Station, by whom the power equipment was furnished.

Wall Street and the Electrical Stock Market.

As Third Avenue Railroad stock furnished the sensation in the market last week so the bulk of attention was centred on American Sugar Refining this week. The dividend prospects of the stock were followed by a decline and then a sudden rise caught the bears sharply. The dealings in the local market throughout the week for foreign account continued in an exceedingly large volume.

On the New York Stock Exchange, General Electric closed the week at 129 bid and 129½ asked, a loss of 1½ points for the week. Metropolitan Street Railway, of New York, closed at 164½ bid and 165 asked, a gain of 2¾ points for the week. Third Avenue Railroad, of New York, closed at 104½ bid and 105 asked, a gain of 1½ points for the week. Brooklyn Rapid Transit closed at 72¾ bid and 73 asked, a gain of 5⅛ points for the week. Manhattan Railway, of New York, closed at 96¾ bid and 96⅞ asked, a gain of 1¾ points for the week.

On the Boston exchange, American Bell Telephone closed at 310 bid and 311 asked, a loss of 4 points for the week. Erie Telephone closed at 101 bid and 104 asked, a loss of 1 point for the week.

On the Philadelphia exchange, Electric Storage Battery closed at 90 bid and 95 asked. Union Traction closed at 40 bid and 41⅛ asked, a gain of two points for the week. Electric Company of America closed at 13 bid and 13⅛ asked, a gain of ⅛ point for the week.

On the curb, or outside market, in New York, Electrical Vehicle closed at 40 bid and 42 asked, a gain of 2 points for the week. Electric Boat closed at 23 bid and 23¼ asked, a gain of ¼ point for the week.

Wall street, March 31.

Important Decision on Direct-Current Ceiling Fan Patents.

The Diehl Manufacturing Company, of Elizabethport, N. J., the well-known manufacturer of direct-current electric fans and motors, has just won an important patent suit, in which several of the company's patents on direct-current ceiling fans have been unqualifiedly sustained. The decision was rendered by Judge Charles C. Cole, of the Supreme Court of the District of Columbia, at Washington, on March 8. The suit was entitled "Diehl Manufacturing Company *vs.* Frederick W. Royce and Morell Marean," although the case was in reality defended by the Marietta Manufacturing Company, of Marietta, Pa., which is now in a receiver's hands. The decision of the court follows in full:

This cause having come on to be heard at the May, 1899, sitting of said Court on the pleadings and proofs; in which proofs the defendants (being defended by the manufacturer of the fan alleged to infringe) have placed in evidence copies of the file wrappers and contents of the patents in suit and the state of the art anterior to the applications for the patents in suit, including prior patents, publications and uses, and have thoroughly contested the questions of infringement, interpretation of claims, invention and novelty of invention and validity of the patents in suit, and the cause having been argued both orally and in print by Livingston Gifford, Esq., counsel for complainant, and William H. Babcock, Esq., counsel for defendants, and the court having held the cause under thorough consideration, it is now,

ORDERED, ADJUDGED and DECREED as follows, to wit:

1. That Letters Patent of the United States granted to Philip Diehl and Edwin H. Bennett, Jr., for improvement in Electric Fans, dated December 15, 1891, and numbered 465 360, are good and valid in law; that the said Diehl & Bennett were and are the original, first and joint inventors of the invention described and claimed therein; that the title thereto and to said invention is vested exclusively in the complainant; that the defendants have infringed on claims 1 and 2 of said letters patent, and on the exclusive rights of the complainant under the same.

2. That Letters Patent of the United States granted to said Philip Diehl for Improvements in Oil Guards for Electric Fans, dated April 16, 1895, and numbered 537,679, are good and valid in law; that the said Diehl was and is the original, first and sole inventor of the invention described and claimed therein; that the title thereto and to the invention described and claimed therein is vested exclusively in the complainant; that the defendants have also infringed upon the same, and the claim thereof, and on the exclusive rights of the complainant under the same.

3. That Letters Patent of the United States granted to Edwin H. Bennett, Jr., for Combined Electric Fan and Electrolier, dated June 29, 1897, and numbered 585,250, are good and valid in law; that the said Bennett was and is the original, first and sole inventor of the invention described and claimed therein; that the title thereto and to the invention described and claimed therein is vested exclusively in the complainant; that the defendants have also infringed upon claims 1 and 5 thereof, and on the exclusive rights of the complainant under the same.

4. That a perpetual injunction be issued in this suit, strictly commanding and enjoining said defendants, and each of them, and their servants, agents, attorneys, employés, workmen and confederates, and each and every of them, from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting or imitating the said inventions as set forth in said claims 1 and 2 of said patent No. 465,360; said claim of said patent No. 537,679, and said claims 1 and 5 of said patent No. 585,250, or either of said claims.

5. That the said complainant do recover of the defendants its costs and charges in this suit to be taxed.

6. And forasmuch as there is no proof that the defendants were notified of said infringement prior to the commencement of this suit, either actually or constructively, and as no damages nor profits have been proved, it is further ordered, adjudged and decreed that this decree be without the recovery from the defendants of any profits or damages received or sustained by reason of said infringement.

The Diehl Manufacturing Company has issued to the electrical trade a circular in which it reminds the public that it published, in 1898, the patent litigation pending against Royce & Marean, to test the validity of its patents, and made the following statement: "As soon as the patents are judicially sustained we will proceed against all dealers in and users of infringing fans for damages and injunction."

The company's patents having been sustained by the above decree, and the use of infringing fans enjoined, the Diehl Manufacturing Company states that it will now proceed in accordance with its warning, and informs the trade that persons who force the company to litigation for the enforcement of its rights will be expected to pay the full measure of damages. The Diehl Company also issues a list of the fan patents it owns, which are as follows: Nos. 414,757, November 12, 1889; 414,758, November 12, 1889; 417,474, December 17, 1889; 425,995, April 22, 1890; 465,360, December 15, 1891; 465,361, December 15, 1891; 510,466, December 12, 1893; 537,679, April 16, 1895; 550,042, November 19, 1895; 585,250, June 29, 1897.

The Development of Safe and Accurate Fuse Protective Devices.

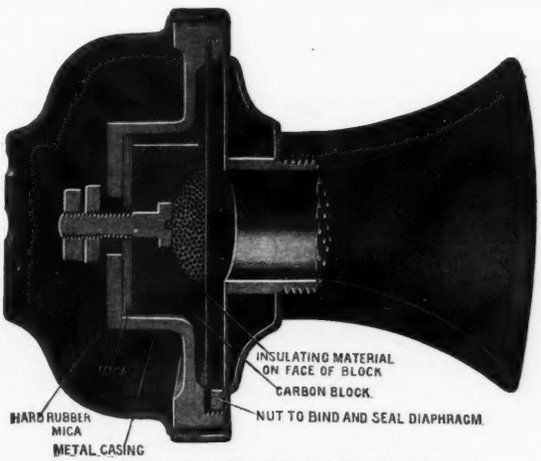
In a paper read before the American Institute of Electrical Engineers upon the general subject of fuses, Mr. Joseph Sachs set forth the history of fuse protection at considerable length. He showed a number of interesting early examples of the enclosed fuse, the most notable of which was the Edison plug now so well known, and traced the development of numerous varieties of cartridge and enclosed fuses from their early beginnings. Mr. Sachs, after considerable discussion of the general principles of protection against excessive currents, laid down the following features as necessary to the proper protective device: (1) a definite, unchangeable maximum continuous current-carrying capacity, and (2) a constant, definite energy overload capacity depending inversely on the overload and adjusted with the allowance of a reasonable safety factor for the apparatus to be protected. In other words, it should be something whose factor of safety is less than that of the circuit to be protected. It should, therefore, operate instantaneously on short circuit, and at time intervals inversely dependent upon the degree of overload. As a further condition its operation should be safe and should not only prevent damage to its circuit, but the fuse should not be able to destroy its surroundings when it gives way. The paper then described at length both the ordinary types of air surrounded fuses and enclosed fuses. It entered largely into a discussion of the phenomena noticed in fuses of the latter type under all conditions of overload and short circuit, and exhibited many details of the construction of such fuses as had been made upon the enclosed principle.

Mr. Sachs spoke of the nature of the metal to be used in fuses and said that copper, but for its high melting point, would be an ideal metal for the purpose. Unfortunately, copper wire, in vaporizing, gives rise to highly conducting vapors and so cannot be used for fuse purposes. The difficulty with the usual lead and tin alloys is that their low conductivity requires a large body of metal to be present. Aluminum and zinc meet the requirements for conductivity and non-conducting vapors as well as any and have been found very satisfactory in practice. Mr. Sachs then described fuses of his own manufacture of the solid packed and enclosed type and described numerous experiments made with them under all conditions of load, voltage and character of current. In these fuses a small indicating wire of high resistance is shunted around the fuse wire and is fastened to the exterior of the case containing the enclosed fuse. The most extraordinary accuracy of rating was claimed by the speaker for fuses of this type. He said that it was possible to obtain safe and accurate fuses having a rating of 0.01 ampere which would blow after 15 seconds of 0.02 ampere. The conclusion to which the author arrived is that perfection has not been reached, but that the principles which he set forth formed good foundations, and that similar devices constructed on the lines indicated could be built, capable of accomplishing results hitherto impossible. Mr. Sachs believes that the increasing use of high potentials and a desire to improve the safety factor of electrical service has made the enclosed fuse in some form a necessity and that it is destined to wide if not universal application.

The discussion was participated in by Messrs. G. S. Dunn, L. W. Downes, W. C. Woodward, H. C. Wirt, W. J. Hammer, F. V. Henshaw, C. O. Mailloux, Fremont Wilson and C. P. Steinmetz.

A Novel Type of Telephone Transmitter.

The accompanying illustration, which represents a section of the transmitter manufactured by the Tucker Manufacturing Company, of York, Pa., practically explains itself. As it clearly shows, the instrument is of granular carbon type, the carbon granules being held in a hollow in a carbon block by the diaphragm which is held by the simple mechanism shown in the illustration, nearly in contact with the front face of this block. One of the peculiar advantages of the construction, as shown, is the ease with which the mouth piece of the transmitter may be cleaned. The parts being easily separable, render the operation of washing the transmitter parts exceedingly simple. As will be noted, there is no provision made for adjustment, it being claimed by the maker that this type of transmitter does not need adjustment to operate continuously with satisfactory results. The mechanical structure shown is exceedingly strong and rigid, while so simple as to leave little opportunity for the parts to get out of order. As the whole structure is composed of metal and non-absorbent materials it is unaffected by dampness and its design is such that temperature changes have no influence upon it.



A Novel Type of Telephone Transmitter.

PERSONAL.

Mr. Charles McLaughlin, of J. H. Bunnell & Company, New York city, started last week on a trip to Mexico.

Mr. C M. Lewis has been appointed superintendent of the Philadelphia, Reading & Pottsville Telegraph Company, with office at Reading, Pa.

Commander Seaton Schroeder, U.S.N., whose paper on "An Electromechanical Battle Order Telegraph" was published in the Electrical Review for February 7, 1900, has been ordered by the Navy Department to relieve Captain Richard P. Leary, U. S. N., as governor of the island of Guam.

Mr. C. F. Scott, chief electrician of the Westinghouse Electric and Manufacturing Company, visited Purdue University on Friday, March 16, at which time he lectured before the engineering students on "Modern Methods for the Distribution and Long-Distance Transmission of Electric Power."

Mr. F. B. Rounds, superintendent of the Metropolitan Street Railway Company, of New York city, has resigned that position to become general manager of the Third Avenue Railroad Company under the receivership of Mr. Hugh J. Grant. Mr. Rounds is a street railway man of experience, and has grown up in the business under the tutelage of President Vreeland, of the Metropolitan road.

Telephone and Telegraph Companies of the United States Compared.

President Charles J. Glidden, of the Erie Telephone system, has been interviewed by the *Daily News,* of Dallas, Texas, in relation to the comparative investments in telephone and telegraph properties of the United States. In the issue of that journal for April 1, Mr. Glidden is reported as giving the following figures:

Telegraph investments:	
Western Union Telegraph Company	$125,000,000
Postal Telegraph Cable Company, exclusive of cables.....	13,000,000
	$138,000,000
Telephone investments:	$137,000,000

This makes a grand total investment in electrical communicating properties of the United States of $275,000,000.

The above figures by Mr. Glidden are quite interesting, showing that nearly the same amount has been invested in the telephone business of the country as is invested in telegraph properties.

A Military Pole-Climbing Contest.

At the recent military tournament which took place in Madison Square Garden, New York city, a novel contest was held between teams from the First and Second Signal Corps of the National Guard of New York state. The contest was for speed in climbing telegraph poles with the ordinary linemen's climbers.

The articles of agreement included the following conditions: Six poles as nearly uniform as possible and erected rigidly in vertical positions were provided, each pole having a spike driven in one side at a point thirty feet from the base, the spike protruding about 12 inches. There were also two sets of wire hoops large enough to slip over a man's head. The poles were arranged in two rows, three in each, at opposite sides of the arena, and the hoops were placed on a table in the centre of the arena in two piles. The contestants were twelve in number, six from each organization, and were all enlisted men who had been members of their respective organizations at least two months, and who had not been employed in the past as professional linemen, and whose duties in civil life did not include pole-climbing. Three heats of three minutes each were to be held, the first one taking place on March 27, and the other two, if necessary, on Saturday evening, March 31.

At the signal to start the contestants each seized a wire hoop and made for a pole, the object of each being to climb up the pole, hang the hoop on the spike and get down again as quickly as possible. Two men were not allowed on the same pole at the same time. The men discovered at once that quick time could be made by climbing as rapidly as possible and sliding down. The first heat was won by the First Corps team.

The second heat was held in the presence of a large audience, on Saturday evening, March 31. The First Corps won again. The work done in three minutes of climbing equalled that required for the stringing of one mile of wire. The contest was held as part of the Military Tournament to exhibit the training of the Signal Corps of the state troops in actual work and to show their high efficiency. This was amply demonstrated.

The stockholders of the Consolidated Traction Company, of Pittsburgh, voted to lease their lines to the Union Traction Company, a new corporation that will take over the Consolidated, United and Monongahela Companies. The two last named have yet to vote on the lease question, but are in favor of it. The new corporation will be capitalized at $30,000,000.

Small Electric Motors for Individual Machines.

The use of small electric motors for running individual machines of all descriptions is increasing rapidly every day. The following are some of the many different kinds of machines with which they are used: Lathes, presses of all descriptions, coffee mills, sewing machines, ice cream freezers, etc. The George C. Towle Manufacturing Company, of Lancaster, Pa., whose stationary power type of motor is shown in Fig. 1, makes a full line of these motors from one-twentieth to two horse-power. They are iron-clad and made dust-proof when necessary. A feature of these motors is that the armature can be removed without opening the case or removing the brush holders, simply by removing one bearing. This makes the motor exceptionally easy to examine or repair. These motors have run continuously night and day for weeks without an increase in temperature of over 40 degrees centigrade.

The field coils, after they are wound, are thoroughly baked for five hours at a temperature of 120 degrees Fahrenheit, then soaked in a specially prepared insulating preparation. After that a coating of fibre is put on and then they are double-taped; lastly they are again dipped in the insulating preparation.

The armature core is made of the best annealed iron, and thoroughly insulated from the winding. The armature is wound carefully, the wires being laid side by side in the slot, and each section is insulated from the other as it is wound on. The resistance of the armature is exceedingly low. The bearings of these motors are self-aligning and self-oiling. By means of a brass ring inserted in the bearing, the oil is carried up over the shaft; thus the shaft runs surrounded in oil.

These motors are claimed to be sparkless at their full capacity and up to 50 per cent over-load. The rise in temperature with full load is less than 15 degrees centigrade. Fig. 2 shows the efficiency curve of the one-half horse-power motor. This motor, with nearly double its rated horse-power, shows an efficiency of 78 per cent. The efficiency of the two horse-power type, which curve is not shown, is 85 per cent. All motors are thoroughly tested with full load for 10 hours before leaving the factory.

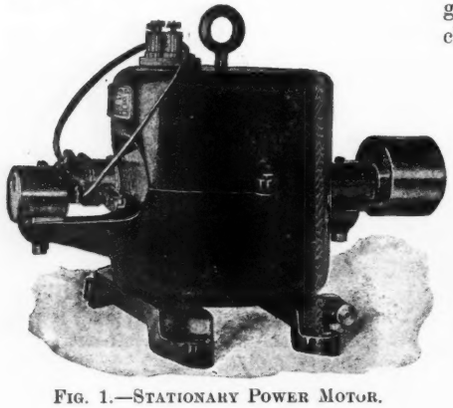
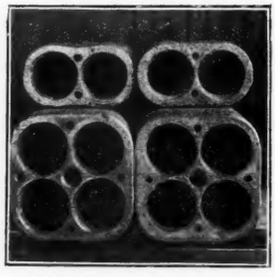


FIG. 1.—STATIONARY POWER MOTOR.



MULTIPLE DUCT TERRA-COTTA CONDUITS.

Multiple Duct Terra-Cotta Conduits.

The illustration shown herewith represents end views of different types of two and four-duct conduits made by the Potomac Terra Cotta Company, at its works, at Terra Cotta, a station situated on the outskirts of Washington, in the District of Columbia. The two points of difference between this conduit and others of the vitrified clay type are in the arrangement of small openings with iron dowel pins at the ends so that alignment of the conduit when laid is secured, and in the nature of the clay. When the conduit tiles come from the kiln they are glazed inside as well as outside. The clay used is of a type that vitrifies at a high temperature, and, as the conduits are baked to the vitrifying point, this action renders them non-porous, non-absorbent and practically indestructible by the elements. The standard length in which they are manufactured is 30 inches, as this size has been found to be the most desirable for general use. The plant of the company at Terra Cotta is exceedingly interesting. The clay deposits of the class used are found in irregular veins located not far below the surface and usually in a hard and dry condition. The earth is broken from the face of the vein with picks and wedges and thence taken in carts to a hopper at the side of the main building, whence it is dumped directly into the first grinding mill. In passing through this the clay lumps are reduced in size and the comminuted material is taken by a belt conveyor to a second mill from which it comes as a fine powder. This is carried again by a belt conveyor to the basement where it is soaked and allowed to temper for from five to seven days. The next process consists in grinding again the wet, tempered clay, which is then ready for molding under steam pressure into the shape of the conduits. A steam heated drying room is used to prepare the molds for baking in the kiln. The kilns are from 22 to 30 feet in diameter and circular, and are burned with a fire started gradually and increased until the contents are brought to a white heat. They are allowed to remain white-hot for from five to seven days, when the fire is removed and the kiln sealed up and allowed to cool slowly. Just before the firing a quantity of salt is dumped into each kiln and the fumes from this, uniting with the heated clay, gives the characteristic glaze upon the inner and outer surface of the tiles.

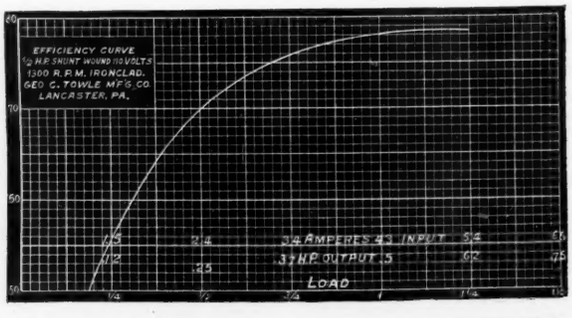


FIG. 2.—EFFICIENCY CURVE OF INDIVIDUAL MACHINE ELECTRIC MOTORS.

Mr. E. P. Bryan, vice-president and general manager of the St. Louis Terminal Railway, has been appointed general manager of the New York Rapid Transit Subway Company. Mr. Bryan will assume his new duties on May 1, and will continue them under a five years' contract at $20,000 a year. He is a practical railroad man and has held several responsible positions. It is understood that Mr. Bryan's present contract is preliminary to his assuming complete charge of the operation of the Rapid Transit Railway when the new underground tunnel is finished.

Mr. James M. Graves, eastern representative of John T. McRoy, the well-known conduit manufacturer, visited Chicago last week.

INDEPENDENT TELEPHONE MANUFACTURERS.

THE ATTEMPT TO CONSOLIDATE NOT YET SUCCESSFUL.

The status at the present moment of the attempt to combine the manufacturers of telephone apparatus, known as the independent manufacturers, is that nine companies of a total of perhaps twenty-six or twenty-seven have practically agreed to the proposed terms, though it is understood that should certain of the remaining large interests fail to enter some of the companies now pledged may withdraw.

It is stated by several of the companies accepting the terms that the proposition advanced is a payment of 50 per cent in cash and 50 per cent in stock in the new organization.

The names of the agreeing companies furnished to a representative of the ELECTRICAL REVIEW a few days ago were as follows:

Sterling Electric Company, Chicago; American Electric Telephone Company, Chicago; Connecticut Telephone and Electric Company, Meriden, Ct.; Phoenix Electric Telephone Company, New York; Williams-Abbott Electric Company, Cleveland; The Telephone Company, Sumter, S. C.; Hipwell Manufacturing Company, Allegheny, Pa.; Victor Telephone Manufacturing Company, Chicago; Western Telephone Construction Company, Chicago.

The companies reported as not accepting and not entering the organization were as follows:

The Holtzer-Cabot Electric Company, Boston, Mass.; The Moon Manufacturing Company, Chicago; Eureka Electric Company, Chicago; The National Automatic Telephone Company, Chicago; The Standard Telephone and Electric Company, Madison, Wis.; The North Electric Company, Cleveland; The W. F. Warner Company, Muncie, Ind.; Couch & Seeley Company, Boston; The Stromberg-Carlson Telephone Manufacturing Company, Chicago; The Williams Electric Company, Cleveland; Central Telephone and Electric Company, St. Louis, Mo.; Farr Telephone and Construction Supply Company, Chicago; Swedish-American Telephone Company, Chicago; Mianus Electric Company, Mianus, Ct.; Ericsson Telephone Company, New York; Spencer Electric Company, New York; Tucker Manufacturing Company, York, Pa.; Viaduct Manufacturing Company, Baltimore, Md.; De Veau & Company, New York; Schmidt & Bruckner Electric Company, New York; Garl-Electric Company, Akron, Ohio; Kokomo Telephone and Electric Manufacturing, Company, Kokomo, Ind.; Utica Fire Alarm and Telegraph Company, Utica, N. Y.

There are other companies whose position has not been announced, but which are supposed to be against consolidation.

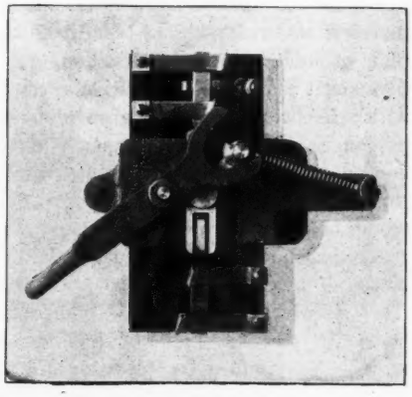


FIG. 4.—QUICK-ACTING SWITCH.

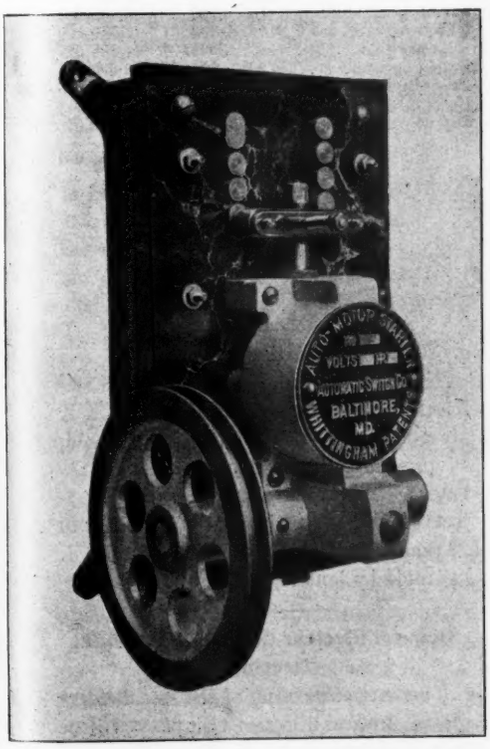


FIG. 2.—SMALL REVERSIBLE CONTROLLER.

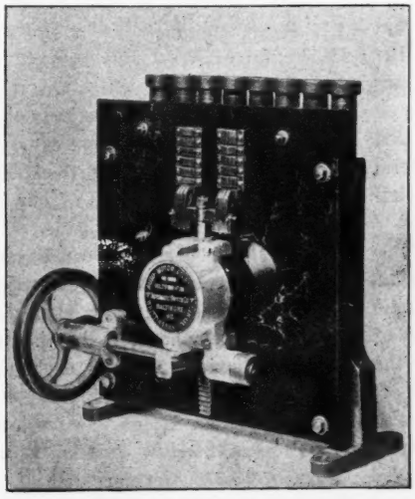


FIG. 1.—AUTOMATIC REVERSIBLE CONTROLLER.

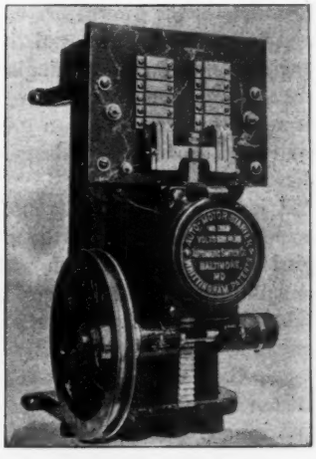


FIG. 3.—NON REVERSIBLE CONTROLLER.

Automatic Motor Starting Apparatus.

The general introduction of direct-connected electrically-driven tools and electric elevators has particularly emphasized the necessity for reliable starting devices by means of which the current supplied to the motor may be handled through a suitable and simple resistance variation apparatus in order to avoid the disastrous consequence of sudden rushes of current.

The illustrations herewith show various types of such apparatus manufactured by the Automatic Switch Company, of Baltimore, Md. These are adapted for driving from the motor which they regulate by means of a small belt connected to any part of its structure. The removal of the resistance is directly proportionate to the speed with which the motor accelerates. The positive nature of the cut-out movement action is such that it can carry heavy metallic contacts and handle large currents if necessary. Upon the cessation of the current the release of the instrument is automatic and upon opening the motor switch it is instantaneous. The construction of these machines is absolutely fireproof. Fig. 1 shows a reversible elevator controller of this type. Fig. 2 shows a small reversible controller of similar type. Fig. 3 exhibits a non-reversible type of controller and is intended to be used with direct-coupled looms, lathes, drill presses, etc. By its use it is claimed that comparatively large motors may be safely handled with a simple make and break switch. To meet the requirements of a quick-acting switch for use with these various types of motor starters the company has brought out the instrument shown in Fig. 4, which comprises an extra contact for controlling the circuit in which is the magnet of the starting apparatus. This extra contact permits the instantaneous return of the rheostat connections to their first position when the current is broken at the switch or elsewhere.

THE AMERICAN BELL TELEPHONE COMPANY.

ANNUAL MEETING AT BOSTON—FINANCIAL STATEMENT.

As stated in the ELECTRICAL REVIEW last week, the annual meeting of the stockholders of the American Bell Telephone Company, at Boston, ratified the sale of the company to the American Telephone and Telegraph Company, of New York. The latter company has a capital of $75,000,000, and it is expected that the operations of the company will all soon be conducted from New York city.

President John E. Hudson, in presenting his annual report, said:

The Long Distance Company had on January 1, 1900, 12,006.83 miles of pole lines and cable, and 150,380.39 miles of wire connecting 323 offices; a gain during the year of 1,927.78 miles of pole line and cables, 27,105.38 miles of wire, and 38 offices.

In all there are 39 companies whose systems furnish our long-line terminals. These companies report a total of 557,979 stations, of which 311,129 (55.76 per cent) are equipped with metallic circuits, and of these 311,129 stations, 26,132 are equipped with long-distance cabinet sets.

The increase in number of subscribers has been more than double that of any previous year. While it is true that this has been due in some small part to the introduction in certain localities of unremunerative rates, to meet similar rates set up by competitors, it is believed that in the main the growth has been healthy and will be permanent, and that the undoubted advantages of a single service on the score of economy, of convenience and of ready connection with a great general system will soon come to be generally understood.

A leading feature of the modern development of the business is the use of measured service in connection with metallic circuits. By far the larger number of subscribers have found that, among the numerous classes of such service now offered, they can advantageously make a selection, and this number is constantly and rapidly increasing.

Large extensions of the properties of the operating companies have been made during the past year, and the construction has been of high standard. More than 115,000 miles of toll-line wire have been added, the larger proportion being of copper, and upward of 240,000 miles of exchange conductors, more than half of which was placed underground.

The work of equipping the large exchanges with central energy switchboards, the type of board now accepted as of the highest efficiency, is going forward rapidly. More than 60 per cent of all the exchange stations in the United States are now connected by metallic circuits.

Much of the development of recent years, not only in the large cities, but in places of moderate size, has been upon the plan of underground construction, with permanent centres of distribution selected with reference to the future growth of the exchanges. Most of the companies have erected at the distributing points buildings especially adapted to the requirements of exchange operation.

The expenditure to provide for the increase of business during the past year has been large, and it is believed that substantially the same rate of investment must be maintained for several years to come, to keep pace with the continued public demand.

The new construction completed in 1899 by companies operating under our licenses mounted to $24,036,822. Of this sum $15,949,463 was expended upon exchange construction and equipment, and $8,087,359 upon toll lines. In addition to the above, $2,066,311 was invested in real estate to be utilized for exchanges and company offices.

The entire expenditure for construction, including real estate, to the close of last year has been $137,262,443.

From the inception of the business the United States has taken the lead of all nations in the broad development of the telephone system.

The important improvements of apparatus of all kinds, by which the telephone can be utilized most effectively, have all had their origin in this country.

At the close of last year, the subscribers connected with exchanges of our licensee companies numbered 632,946.

The latest reports that can be obtained, most of which are for the year 1898, show the countries next in order, as respects the use of the telephone, to be the German Empire, having 212,121 exchange stations; Great Britain, 112,840; Sweden, 63,685; France, 44,865; Switzerland, 35,536; Russia, 26,865; Austria, 26,664, and Norway, 25,376, the aggregate of stations in all these countries falling well below the number in our own country.

The Long Distance Company had invested, up to December 31, 1899, in line construction, franchises, equipment and supplies, $17,118,509. The company shows an increase in gross earnings in 1899 over 1898 of 27.17 per cent, the amount for 1899 gross being $2,805,012.

The financial report shows net earnings, applicable to dividends, of $4,072,949, a decrease of $321,017. These net earnings are equivalent to 15.8 per cent on the $25,836,300 stock outstanding as against 15 per cent paid.

The earnings and expenses and ledger balances for the past two years, compiled for comparison by the Boston *News Bureau*, are as follows:

Earnings:	1899.	1898.
Rentals	$1,714,526	$1,610,855
Dividends	3,809,504	3,239,406
Ex. territorial	....	121,511
Telegraph	....	18,389
Real estate	84,692	83,864
Interest	149,434	370,991
Miscellaneous	1,948	3,682
Total	$5,760,106	$5,448,701
Expenses:		
Operation	591,826	509,673
Legal expenses	103,748	94,226
Real estate	42,407	40,235
Interest and taxes	928,695	408,851
Miscellaneous	20,479	1,747
Total	$1,687,155	$1,054,734
Ledger balances, December 31:		
Telephones	$3,488,850	$2,248,532
Real estate	1,271,961	1,052,695
Stocks and bonds	70,975,500	58,776,425
Mdse. and machinery	23,846	18,270
Bills receivable	9,272,336	2,086,092
Cash and deposits	584,953	676,987
Total	$85,617,447	$64,859,004
Creditors:		
Capital stock	25,886,300	25,886,300
Premium account	6,110,582	6,110,582
Debentures	10,007,500	5,049,000
Bills payable	4,214,557	1,277,827
Patent account	12,345,975	12,399,147
Profit and loss	19,148,943	6,851,515
Reserve	4,928,513	4,499,558
Surplus	2,975,078	2,785,073
Total	$85,617,447	$64,859,004

The company had in use at the end of the year 1,580,101 telephones and 1,239 exchanges and 1,187 branch offices; the total mileage of wire was 1,016,777, and the number of daily connections 5,173,803.

Chicago Electrical Association.

The next meeting of the Chicago Electrical Association, at which Professor I. J. Macomber will read a paper, will be held, as previously announced in the ELECTRICAL REVIEW, on April 6, but the subject of the paper has been changed to "Transformer Designs." It will be illustrated by lantern slides.

General Electric Company's Annual Meeting.

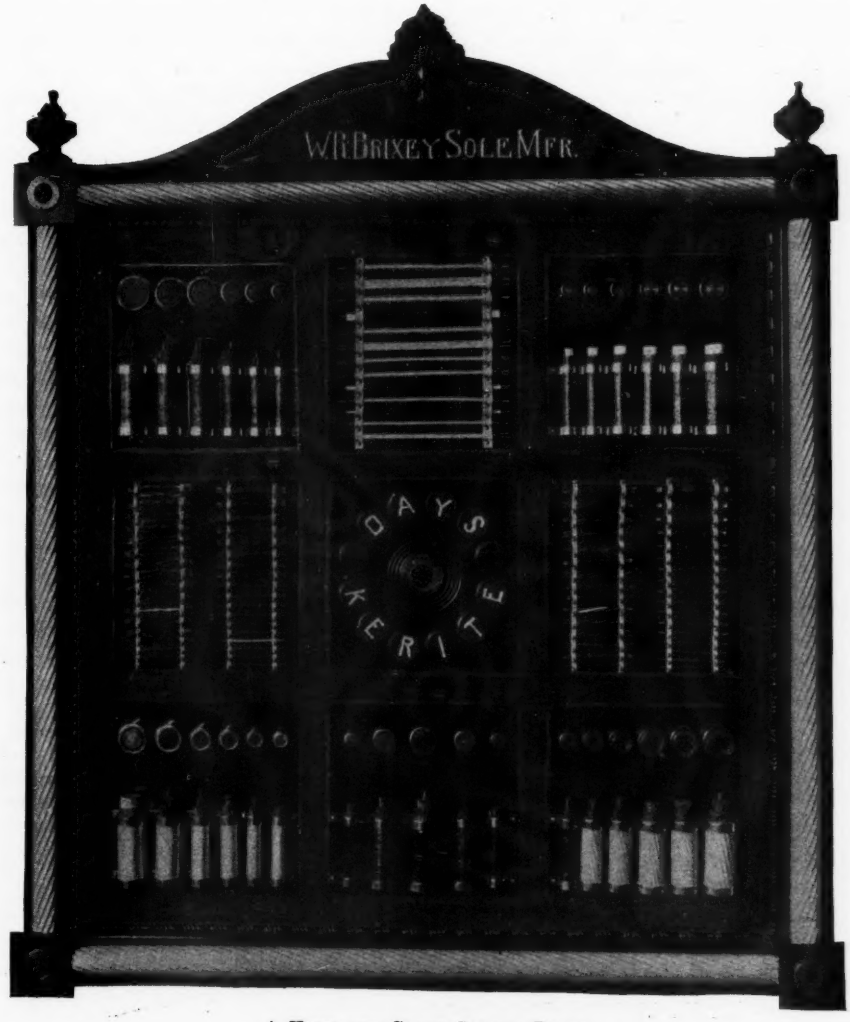
The annual meeting of the stockholders of the General Electric Company will be held at Schenectady, N. Y., on Tuesday, May 8, at 12 M. The transfer books will be closed at 12 o'clock, April 14, and reopened at 10 A. M., May 9.

General Electric – Siemens-Halske.

It is announced from Chicago that the Siemens-Halske Electric Company of America has been acquired by the General Electric Company. The terms are not stated.

A Handsome Cable Sample Board.

The accompanying illustration shows one of several handsome sample boards prepared by Mr. W. R. Brixey, of New York city and Seymour, Ct., to show in longitudinal and cross-section a few samples of "Kerite" wires and cables. The board is about four feet square and is made of mahogany, cherry and quartered oak. Excellent cabinet work is apparent in the panelling. The corners are ornamented with cross-sections of double-armored sub-marine cable, and the larger part of the wooden framework is made in imitation of iron-armored cable.



A Handsome Cable Sample Board.

The samples shown on the board are "Kerite" wires and cables for aerial, underground and sub-marine service in the distribution of currents for railway, police and fire-alarm signal work, telephones, telegraphy and electric lighting, and power purposes. The sample board illustrated will be sent by Mr. Brixey to Japan, for the use of the Japanese Government.

AUTOMOBILES

One of the lightest electromobiles that has yet been produced is manufactured by the Elgin Automobile Company, Elgin, Ill., whose general offices are in Chicago. The carriage, complete, weighs about 1,000 pounds, and is operated by 40 cells of Willard battery, manufactured by Sipe & Sigler, Cleveland, Ohio.

A project is on foot to construct an automobile road from New York to the mountain region of New Hampshire. John D. Quackenbos, of New York, is the prime mover in the scheme and Governor Rollins and N. J. Bachelder are cooperating with him. The highway would go from New York through the northern part of Connecticut into the Berkshire region in Massachusetts and pass from Vermont to New Hampshire at Bennington. In New Hampshire it would touch the lake region at Sunapee and Winnepesauk, go up the west side of the mountains as far as Lancaster, and then east down through Dixville Notch to the seacoast.

The signal corps of the United States army has recently been supplied with electric automobile wagons for use in the Philippines. These wagons are of two kinds, one to carry the instruments and material and the other to carry the personnel. The first is built like a covered ambulance, with rubber-tired wheels, and contains a storage battery capable of running the vehicle for 30 hours on one charge when carrying 1,500 pounds of load. There are two 3½-horse-power motors, one in each rear wheel. The maximum speed is about 10 miles an hour. The other wagon is constructed like a high cart and is in other respects similar to the first. Both wagons are fitted with electric side lights, and the first also has electric lights in the interior. Other military applications of the automobile have been considered by the military world, but this is the first actual introduction.

Thomas M. Moore, recently appointed Chief of Transportation and Machinery Exhibits, at the Pan-American Exposition, to be held in Buffalo, May 1 to November 1, 1901, who is working on preliminary arrangements for these exhibits, makes the following statement: "The preliminary and merely mechanical work was our first care when we issued a letter to prospective exhibitors. The letter was sent out to the automobile manufacturers, those who make the vehicles and those who own the motor systems especially designed for the propulsion of these vehicles, and to all others who have made a study of automobiles and could aid us in making the Pan-American display of such vehicles a pronounced success. Up to now, exhibitions of automobiles have been but tentative, for the art is in its formative state and is but now reaching a point where practical results can be shown. Our success so far has been gratifying and assures us of great success in this particular unit of our exposition. Replies are reaching us from all directions; and while we, in the letter referred to, did not solicit exhibits, but asked only for suggestions as to a plan for display by evolutions, races, etc., nearly 75 per cent of the responses inform us of the desire to cooperate with us and of the determination to make the best possible exhibit. Our correspondents evince a cordial spirit, and with hardly any exception, promise to do all in their power to aid us."

VIEWS, NEWS AND INTERVIEWS

Mr. C. E. Corrigan, the general manager of the American Electric Vehicle Company, of New York city, is well known to the electrical fraternity and others as a pioneer in the manufacture and especially in the commercial development of the electromobile. Before the American Electric Vehicle Company established its factory in Hoboken, N. J., and its offices and repository in New York city, it was an Illinois corporation, with its principal place of business at Chicago. Readers of the ELECTRICAL REVIEW may remember that something over a year ago the South Park Board of the city of Chicago objected strenuously to the operation of electromobiles on the city's boulevards. It will also be remembered that Mr. Corrigan was a pioneer in securing from the Park Board proper rights for electromobiles. In response to a query from a representative of the ELECTRICAL REVIEW as to the circumstances under which these rights were acquired he told the following story:

"A certain member of the South Park Board, who is an eminently respectable but rather crotchety gentleman," said Mr. Corrigan, "is a great admirer of fine horse flesh and has in his stables some handsome specimens of the equine race. Among others was a pet team in which he took great pride. After I had been driving an electromobile for some time up and down the boulevards, several gasoline vehicles, whose pounding could be heard half a mile away, and whose odor could be distinguished three-quarters of a mile away, were imported into Chicago and made their appearance in the parks and on the boulevards. The Park Commissioner, whom we will call Mr. Smith, was one day on his way to a meeting of the Park Board in a light wagon behind his pair of pet high-steppers. He heard a noise, like the surging of the wind through a canyon and the pounding of a mimic horse on the stage approaching him from behind. His pet horses also heard it and commenced to edge to one side of the road. Fortunately, Mr. Smith, being an excellent horseman, controlled his thoroughly frightened team until the 'devil wagon' had passed. This experience was especially unfortunate for the owners of automobiles of all sorts in Chicago as, as I remarked before, Mr. Smith was on his way to a meeting of the Park Board. All this happened on Saturday.

"When Mr. Smith arrived at the meeting of the Park Commissioners he was naturally full of his recent experience, and proceeded to offer a resolution providing that, 'pending the passage of an ordinance prohibiting automobiles of every sort from the use of the city's streets, parks and boulevards, such vehicles be and hereby are prohibited from the use of the parks and boulevards which are under the jurisdiction of the Park Board.' Mr. Smith, having a certain following in the board, secured the passage of the resolution which was to take effect on the following Monday. The penalty for disobeying the resolution was arrest.

"As soon as I was informed of the state of affairs I saw large complications looming up in the distance, as, of course, the matter would have to be brought to a test at once. The Park Commissioners having their own police force separate and distinct from the city police force, did not always agree with them in matters of arrest or confinement pending bail, and it was only by courtesy that the city station houses could be used for prisoners arrested by the park police. Any one at all familiar with the practice of inferior courts, especially the police courts, will at once imagine what a state of affairs such action promised.

"About eight o'clock on Monday morning I walked down to a certain boulevard and had a conversation with Dennis Sullivan, a policeman not quite nine feet high, whom I had known for some years.

" 'Dennis,' said I, 'What are your orders about automobiles on the boulevard?'

" 'Me orders, sir, are to arrist the first one I see.'

" 'Dennis, you stay here half an hour, because I am coming back with my electromobile to be arrested.'

" 'Now don't you do it, Mr. Corrigan. I have to do me dooty, and it will only make trouble for you.'

"When I assured Dennis, however, that I was really coming back with my electromobile, for which I had telephoned in the meantime to meet me at a certain nearby street, he said:

" 'If you must do it, come on the Boulevard four blocks below me where Mike Kelly will have to make the arrist. I don't want to do it.'

"I then went to the appointed street corner where I was met with an electric runabout by our chief engineer, Mr. H. G. Osburn, who is as jovial and cheerful a big man as any one ever knew. I informed him as delicately as I could that I should have to have him arrested, because, if I were arrested for running an electromobile, it would leave no one to attend to bailing us out, as I had been handling the legal matters connected with our concern. Mr. Osburn's demeanor at once indicated his chagrin and lack of desire to perform the part of willing criminal. Nevertheless, after I had climbed aboard, he started the electromobile toward the boulevard, his facial expression being one worthy of preservation. As we turned the corner into the wide avenue we saw, about fifty feet away, the large form of Dennis Sullivan, policeman. As we came toward him he rushed out into the driveway, raised his hands above his head, and commanded us to 'Stop!' I will admit that Dennis looked all of his height and as wide as a barn door. Osburn ran the vehicle as close to him as possible and Dennis reached around, carefully avoiding me, and informed Osburn that he was his prisoner. I got out, Dennis Sullivan climbed aboard, and Osburn started to take himself to the police station, I in the meantime following on foot.

"Numerous complications, as I expected, did arise, the most annoying of which was confining Mr. Osburn in a dirty cell in the Harrison street police station. As every one knows who has read Josiah Flynt's 'Tramping with Tramps,' this station is not a Waldorf-Astoria. The height of ignominy came when a large Irish turnkey passed Osburn's cell at twelve o'clock and offered him a tin can of greasy soup and a hunk of bread. I don't remember exactly who Osburn's cell-mate was, but I think it was a Chinaman.

"The complications I have referred to included getting the matter out of the hands of the police and police courts and before a court of record, which we finally succeeded in doing. In the meantime I had persuaded the Park Board to be bound by the decision of the court which, as you know, was favorable to the electromobiles and automobiles of all classes, giving them the broadest rights, if anything a little more than equal to those of horse vehicles. This case has been quoted as a precedent many times since."

The Western Union wires were crossed in an extraordinary manner north of Franklin, Pa., a few days ago. The lineman who was sent out to remove the trouble handed in the following report on his return:

"Found 8, 19 and 21 crossed by a dead calf, between Rockwood and Eagle Rock. Removed trouble."

This report was literally true, one half of a calf having been found tangled up in the wires, causing a cross, while the balance of the calf's body was lying on the ground beneath the wires. How the calf got among the wires is a mystery, but it is supposed that it was thrown there by the locomotive of some passing train.

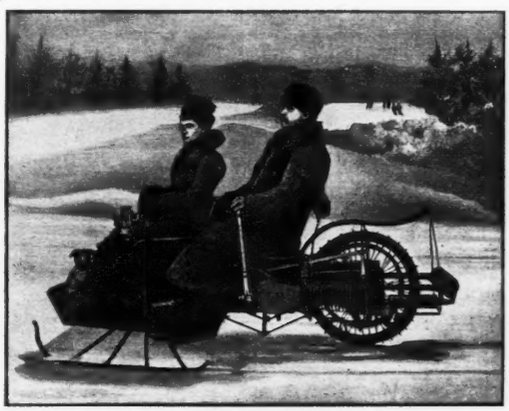
NOTES ON ELECTRIC TRACTION UNDER STEAM RAILWAY CONDITIONS.

BY EDWARD C. BOYNTON.

(*Concluded from page 301.*)

The question of heating a standard coach by electricity is one that should be thoroughly understood. Street car heating is totally different. The public demands the same temperature as is furnished by steam, which is 68 degrees or 70 degrees Fahrenheit. It makes but little difference what heater is used, provided there are enough of them. One may radiate its heat faster than another, and so raise the temperature of the car more rapidly, but it will require, in any case, from 12 to 15 kilowatts of energy for each coach. An ordinary train, consisting of a motor car and two coaches weighing 200,000 pounds, will require, at a speed of 35 to 40 miles per hour on a level track, about 125 kilowatts, or about 166 horsepower, of which the car alone would consume 75 kilowatts, if running light. The motor will consume an average energy of four to five kilowatt-hours per train mile, or 40 to 50 watt-hours per ton mile. Power can be produced with condensing engines and fuel at about $2.30 per ton, for about .008 (eight-tenths of a cent), per kilowatt-hour.

Cost of Operation.—It is most desirable in operating a heavy electric service over a railway on which steam trains are also operated, to arrive at a satisfactory conclusion as to the comparative cost of operating each type of train per mile. If an electric service is entirely substituted for one which has been operated by steam, the railroad company is in a position to know accurately the difference in cost of the two systems. But when both are operated over the same tracks the problem becomes very complex. For example, even if we omit the maintenance of the roadway, which may be a little higher in an electric service, there are many other items such as salaries of agents, ticket sellers, gatemen, etc., all of which properly belong to the operating department, which must be proportioned between the two services. It may be said that the cost of operating a steam passenger train has been estimated all the way from 30 cents to $1 per mile, depending upon the length of the train and other conditions which are seldom alike in the different localities. The author can not go into this subject in detail, but will give a few points of difference between the two services upon which an approximate estimate can be based. A fair average cost of running a steam locomotive, including fuel when coal is about $2.30 per ton, water, wages, repairs, etc., is 22 cents per mile. The average cost of repairs to coaches may be taken at one cent per mile each. The wages of train crew, consisting of a conductor, baggage master and one brakeman will average five cents per mile, making a total of 30 cents. This figure is intended to represent the lowest possible cost of operating a train of only three cars by steam with the understanding that it is kept almost constantly moving for about nine hours, and covering from 150 to 200 miles. It is well known that a train making but a few miles per day can not be run at a profit, either by steam or electricity, due to the fact that cost of wages per mile increases rapidly, as the crew has to be paid the same in either case. A great advantage of the electric service may be mentioned here. The above service is all that can be required of one crew and one locomotive, but the motor car can easily make 300 to 400 miles in 18 hours, and as the daily service is in operation at least that long, one motor car does the work of two locomotives. In the operation of a similar three-car train in which one car is a motor car, we will assume the same crew with the addition of a motorman and omit the locomotive. The cost per mile in wages will then become six and one-half cents, that of repairs to cars the same as before, one cent, maintenance of motors, one-half cent, and cost of power delivered to train, six cents, making the total cost per train mile, 14 cents for the electric service.



AN AUTOMOBILE SLEIGH.

All steam roads which have introduced electric motive power will consider the question of lighting their passenger stations and freight houses along the line. It will be found that lighting in this way is very satisfactory and far cheaper than the purchase of gas or electricity from others. For lighting freight sheds, platforms and other outside lights, the simple wiring of the lights in groups of five or six in series and connected directly between the feeder or working conductor and the service rails, has been found satisfactory. The occasional interruption of the current due to the opening of a circuit breaker will shut off these lights for a few seconds, which makes them inconvenient for indoor lighting. For stations requiring not over 60 16-candle-power lights, a small storage battery of 58 cells, together with a rheostat and switchboard, with the necessary switches and instruments can be installed for about $900. By making the rheostat of about 55 ohms resistance and 35 amperes capacity and connecting it in series with the railway current it can be used to charge the battery.

The battery and rheostat are connected in parallel with the lighting load, and the resistance so regulated that the railway current does the lighting, the battery merely acting as a regulator, charging slightly when the voltage rises and discharging into the lighting circuit when the pressure falls, due to the movement of the trains. This maintains a practically constant voltage of about 120 on the lighting circuit, and the battery does little or no work except when the power station is shut down. The principal advantage of this arrangement is that it is practically automatic in its action, and requires no regular attendant. The station employees can handle the switches when necessary to turn on or off the lights. An occasional inspection of the battery is all that is necessary. The cost of such lighting is much less than it can be purchased from lighting companies. In larger stations requiring several hundred lights, a motor generator can be used instead of the rheostat and connected to the battery and the load in exactly the same way. Such a plant should have an attendant.

An Automobile Sleigh.

The curious automobile sleigh shown in the accompanying illustration consists of a Bollee gasoline automobile altered by the removal of its front wheels and their replacement by runners to adapt it to be used on ice and snow. A wooden rim carrying conical points is put around the rear motor wheel and gives a sufficient bearing on the surface of the ice to propel the vehicle. This curious automobile was designed and made by Dr. E. Casgrain, of Quebec. The reservoir of gasoline holds enough for a run of 45 miles and the motor develops two horse-power. The vehicle can be speeded at will from 5 to 14 miles per hour. The whole running gear and frame of the machine is made of hollow tubing, the front runners doing the steering. We are indebted to the *Literary Digest* for the illustration of this interesting automobile.

Alfred F. Moore Burned Out.

Alfred F. Moore, the well-known covered wire manufacturer, of Philadelphia, lost his building, at 200 to 218 North Third street and 301 and 303 Race street, with all its contents, by fire on the night of March 21. The fire originated in the basement in some unknown fashion. The entire loss is covered by insurance.

The First Link of the Trans-Pacific Cable.

A bill appropriating $3,000,000 for a cable from San Francisco to Honolulu was favorably reported to the Senate by the Committee on Naval Affairs, on March 20. The bill states it to be the purpose hereafter to extend the cable to Manila. It authorizes the Secretary of the Navy to enter into contracts for the cable and to use vessels of the Navy for laying it if that is thought expedient. The cable, instruments, etc., are to be of American manufacture if the cost is not 12 per cent greater than that of like material in the foreign markets. When completed the cable is to be operated by the Post Office Department.

"The increased business of the United States upon the Pacific sea," says the report of the committee, "has for years drawn men's attention to the advisability of an ocean cable between our western coast and some point on the Asiatic shore. The annexation of the Hawaiian Islands has added to this feeling, and the committee has felt itself justified in reporting a bill which provides for a cable, which, if built, will be the beginning of a trans-pacific submarine cable. Both schemes, the one for a Government built-and-owned cable and the other for a cable built and owned by private enterprise aided by governmental subsidy, were fully laid before the committee both through hearings and arguments and memoranda of facts sent to the committee and printed by the order of the Senate."

After these hearings and a full investigation the committee unanimously determined to report in favor of the accompanying bill, says a press telegram. In the opinion of the committee its provisions are ample to insure the completion of the work by private enterprise, while leaving the general charge of it with the Government and the ownership there when completed. At any rate the experiment will be made in the building of the short end of the line, from San Francisco to Honolulu, and the future course can be governed by the experience gained in this work.

The committee believes that the cost of the line between the two places named will be not far from $3,000,000, and if the bill becomes a law at the present session of Congress the hope is expressed that the work may be under way within a year.

The Boston, Mass., Electric Light Company has declared a regular quarterly dividend of two dollars, payable April 14. Books closed March 31 and open April 16.

FIRE DRILL FOR TELEPHONE GIRLS.

[From the New York Evening Sun.]

It is not generally known that a large body of young women in New York go through a fire drill every week. They are the telephone operators employed at New York's many "centrals." All the large telephone exchanges in New York are in fire-proof buildings, most of them built especially for telephone purposes, but fires occur even in fire-proof buildings. There are over a thousand telephone operators employed in Manhattan, and in each of the larger exchanges more than a hundred girls are on duty at once during the busy hours of the day. With such large forces it is essential that in the case of an alarm of fire a panic should be averted and an orderly exit made. Also that some measure should be adopted to protect the costly telephone switchboards. Curiously enough, the switchboards need protection against the firemen more than against fire, as a very little water will do them more harm than a moderate amount of flame. Consequently the fire buckets at a telephone exchange are filled with sand instead of water, and every switchboard is provided with a tarpaulin cover, which is normally reefed along the top of the board, so that it can quickly be let down by the operators. The fire drill is controlled by the manager of the exchange, who gives the signals by means of a gong. At the first signal the operators stand up and push their chairs back clear of the switchboard, at the next they release the tarpaulin cover, which completely envelopes the huge collection of delicate wires and apparatus, and at the third they file out of the room in proper order. This drill was instituted by the officials of the New York Telephone Company a number of years ago. Last month it was put to a practical test at the Harlem exchange when a fire occurred in the store room on one of the lower floors of the building. The operators covered the switchboard within 20 seconds of the first signal and marched to the street without a sign of panic, all hands being in the street within two minutes. The fire was put out promptly and did not reach the operating room, so that in a few minutes they were able to return to the operating room, where within 30 seconds they had furled the water-proof cover and resumed the work of answering subscribers' calls.

Westinghouse Dividend.

The Westinghouse Electric and Manufacturing Company has declared a regular quarterly dividend of one and three-quarters per cent on its preferred stock, payable April 2. Books closed March 24 and reopen April 3.

Detroit Three-Cent Fare Ordinance Declared Invalid.

Last August the Common Council of Detroit, Mich., passed an ordinance requiring the Citizens' Street Railway Company to carry passengers for three cents. The ordinance was based on a clause of the company's franchise which reserved to the city the right to make "such further rules, orders and regulations as may be deemed necessary to protect the interests, safety welfare or accommodation of the public in relation to such railways." The company's franchise authorized it to charge not more than five cents for a single ride. Mayor Maybury signed the ordinance and the street railway company enjoined the city from enforcing it.

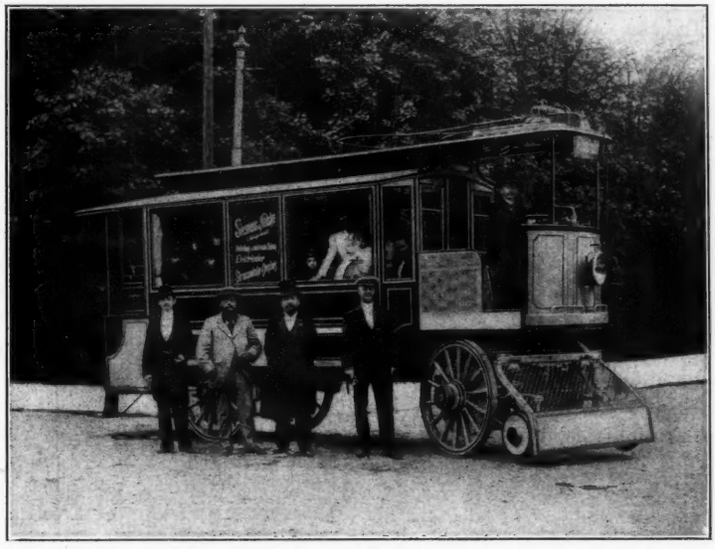
On March 19 Judge Swan, of the United States District Court handed down a voluminous opinion deciding to grant a perpetual injunction. He holds that the rights conferred by the original grant and the subsequent grants are vested rights and can not be vacated or abridged without impairing the obligations of contracts. The assertion that the city can reduce fares from five to three cents by exercising police power is declared untenable. An attempt to do so is tantamount to an attempt to deprive the grantee of a vested right without compensation. Not even the legislature could impair the right of the company to collect five-cent fares. The city can not sequestrate any part of the earnings of the company under the contract. It would be confiscation.

Mayor Maybury will take the case to the Supreme Court of the United States.

Superintendent Roycraft, of the Grand Forks (North Dakota) Gas and Electric Company, announces that the plant of the company is to be entirely remodeled and important changes in the system are to be made. The present current is alternating, and a direct current is to be used instead. The lighting system will be changed somewhat, but the most important change will be the installation of an electric power system by which power will be transmitted from the central plant all over the city. A new building is to be erected for this purpose and a 400-horse-power steam plant will be put in at once. This is to be supplemented by power transmitted from the Crookston water works, and it is expected that the latter, under favorable conditions, will furnish all the power required. In case of high or low water, broken wires, etc., the steam plant will be put in operation. These improvements, together with those which the company will make in installing the central heating plant, will cost over $50,000, and will result in giving Grand Forks the best light, heat and power service of any city in the Northwest.

A Trolley-Car Electromobile Combination.

In German cities there is a strong prejudice against tracks in the streets and trolley wires overhead. At Hannover the municipal authorities permitted tracks, but ruled out the trolley wire from the central parts of the city, so that it was arranged to equip the cars of the street railway in that city with accumulators. These were charged while the car was in the suburbs and operated as an ordinary trolley car, the current being supplied from the overhead line. When the car entered the crowded central parts of the city its trolley was tied down and the batteries supplied power.



A Combined Trolley Car and Electromobile.

This installation proved to be remarkably successful and has led to the design of the curious composite vehicle shown in the illustration. It is, in reality, an electromobile omnibus, fitted with a trolley and flanged wheels in addition to its equipment of accumulators. In running on tracks the flanged wheels in front are let down to serve as guide wheels and keep the vehicle on the track. When the vehicle leaves the tracks for the road these wheels are lifted up and the trolley fastened down, when it becomes an ordinary electromobile.

The vehicle carries four motors of four horse-power each and weighs, all told, about 14,000 pounds. Of this, the batteries represent about 3,300 pounds. The steering gear is very powerful and is fitted with ball bearings.

The omnibus is at present at use in Berlin. Its builders, the Siemens & Halske Aktien-Gesellschaft expect it to find considerable use both in narrow streets where tracks are prohibited, and as an adjunct of street railway systems desiring to extend their traffic to suburban districts where it would be undesirable to construct tracks.

Book Reviews.

"Polyphase Alternating Currents and Alternate-Current Motors." By Sylvanus P. Thompson, second edition. Cloth, 508 pages, 358 illustrations, 24 colored illustrations, 8 folding plates. New York, Spon & Chamberlain. Furnished by the Electrical Review at $5.00.

The first edition of Professor Thompson's excellent work on polyphase machinery met with so favorable a reception and is so widely known among electrical readers that it is hardly necessary to enter into an extended review of the present volume. Perhaps the most noticeable changes that have been made are the addition of colored plates which add greatly to the elucidation of somewhat complex winding and other diagrams, and the considerable enlargement of the chapters on graphic theory. The work is also remarkable in having reduced the use of formulæ to the least amount and for its expression in plain English of the greater part of the phenomena of which it treats. Like most other works emanating from Great Britain, however, it concerns itself more with foreign types of apparatus than with American; but this can hardly be called a fault, since a great quantity of valuable information regarding these machines is given. The book in its appearance and typography reflects great credit upon the publishers and is one which is destined to occupy the same place with regard to alternating machinery that the same author's valuable treatise on dynamo electric machines has filled for many years with relation to direct-current machinery.

OBITUARY.

Mr. W. J. MacConnell died at Philadelphia, on March 25, from complications following an attack of the grippe. He was for a long time identified with technical journalism, having been recently a member of the staff of the *Engineering Magazine*. He left a widow and one young child.

Amelia Dickinson Pope, widow of the late Franklin Leonard Pope, died of heart failure in Amherst, Mass., on March 20. The funeral service was held at Amherst on the 22d, and the interment was at Great Barrington, Mass., on the following day. Her only son, Leonard, is a student at Amherst College, the eldest daughter, Anna, is attending the University of Wisconsin, and the youngest daughter, Amy, is at Smith College, Northampton, Mass.

Bernard M. Shanley, financier and contractor, died at his home, in Newark, N. J., a few days ago. Mr. Shanley was born in Newark, November 1, 1847. He began his business career as a clerk in New York city. Mr. Shanley was believed to be one of the wealthiest men in New Jersey. He owned much stock of the Pennsylvania Railroad, for which he did a great deal of contract work. In addition to having vast trolley railroad interests in New Jersey, he was a director of the City Trust Company, of New York; the Fidelity Trust Company, of Newark, and the Title Trust Company, of Jersey City. Mr. Shanley engineered all the big gas, electric light and trolley deals in Essex, Hudson, Union and Passaic counties in recent years. What he regarded as the most gratifying occurrence in his career was the fact that a syndicate of capitalists, among whom was the late Vice-President Hobart, placed in his hands $2,000,000 with which to bring about a consolidation of numerous trolley lines into the North Jersey Street Railway Company and required no receipt from him.

The Automobile Club's Exhibition.

The show of the Automobile Club of America next Autumn at Madison Square Garden, in New York city, is now an assured fact. The directors of the club have approved of the preliminaries and authorized the leasing of the big amphitheatre from Saturday, November 3, to Saturday, November 10. Already manufacturers and riders are much interested in the plan of offering prizes for stopping, starting, turning curves and hill climbing. There is at present every probability of the foreign manufacturers making a determined effort for a share of the American trade, so that the Madison Square Garden show is likely to take on much of an international aspect.

TELEPHONE AND TELEGRAPH

Details of a plan for the proposed exchange of Erie Telephone Stock at 120 for bonds will probably be presented to Erie stockholders early in April.

The American Bell Telephone Company has declared a regular quarterly dividend of $3 per share, payable April 16, The transfer books will be closed April 2 to 14 inclusive.

Representatives of independent telephone companies in Pennsylvania will meet at Harrisburg on April 10, when a plan for establishing a long-distance system will be considered.

The Cincinnati, Ohio, City and Suburban Telegraph Association has just brought out a new directory which is in many ways a model book of its kind. It is thoroughly indexed and well arranged.

A certificate of increase of the capital stock of the Hudson River Telephone Company from $2,000,000 to $3,000,000 has been filed with the Secretary of State of New York state. The debts and liabilities of the company it is stated amount to $100,000.

The Commercial Cable Company announces that telegraphic communication has been restored with Bloemfontein, that a military telegraph office has been established there and that telegrams in plain language will be accepted for that town at sender's risk.

The merchants of Ravenna, Ohio, have formed a stock company and have purchased the independent telephone plant at that place The directors elected are: E. M. Waller, E. R. Taylor, W. W. Stevens, C. H. Pitkin, E. E. Morgan, J. F. Babcock and H. L. Beatty. The directors elected H. L. Beatty president and W. G. Krake, secretary and treasurer.

The Telephone, Telegraph and Cable Company of America is negotiating for the control of several large independent telephone systems in Illinois and Pennsylvania. It is said the control of the Kinloch Independent Telephone Company, in St. Louis, will shortly pass into the hands of this corporation. President Latta said recently that none of the $30,000,000 capital stock would be offered to the public.

Stockholders of the Bell Telephone Company, of Philadelphia, met on March 20 and by unanimous vote resolved to increase the capital stock from $4,000,000 to $6,000,000. Joseph E. Gillingham, who presided at the meeting, said that the increase was necessary for the development of the plant. He said that there had never been a thought of selling the property nor of purchasing or leasing other franchises.

It is stated by a Philadelphia interest connected with the Telephone, Telegraph and Cable Company that the latter has purchased the Market street conduits, wires and poles of the Standard Telephone Company. The Standard Company is among those whose franchises have just been repealed. The acquirement of the Standard Company conduits is the first tangible evidence of the new enterprise in the Philadelphia local field.

The Indiana & Illinois Independent Telephone people have perfected an organization and elected the following officers: President, Charles R. Duffin, Terre Haute; vice-president, J. L. Horney, Clinton, Ind.; secretary, H. L. Colt, Terre Haute; treasurer, J. B. Connelly, Rockville; executive committee: A. M. Adams, J. G. Schanch, C. W. Schimmell, H. K. Cole, J. W. Gilmore and C. L. Wilson. The committee reported a new uniform rate schedule and a constitution was adopted.

The Chicago Telephone Company has declared a cash dividend of three per cent for the first quarter of this year and a stock dividend of $1,000,000. Stockholders will be privileged to subscribe for $500,000 additional stock at par. The stock is now in the neighborhood of 225. Next October there will be a second issue of $500,000 of new stock at par. The outstanding capital is $5,000,000, and the distribution of the stock dividend will be in the ratio of one share of new stock for each five shares of old.

The New York State Board of Tax Commissioners has given a hearing on objections by the American Telephone and Telegraph Company to the valuation the board had placed on the company's franchises in Buffalo, Rochester and Ithaca, the amounts being $55,000, $12,000 and $1,450, respectively. These valuations. it was contended, were excessive and were evidently made by the board under a misapprehension of the character of the franchises of the company in those cities. The company connects with the lines of the local telephone companies in each of the cities and transacts nothing in a long-distance telephone business. In Buffalo and Rochester it uses the lines of the local companies and in Ithaca it has its own wires and poles.

Southwestern Gas, Electric and Street Railway Association.

The date of the annual meeting of the Southwestern Gas, Electric and Street Railway Association, at Waco, Texas, has been changed from April 18, 19 and 20, to 12th, 13th and 14th days of the same month.

The change was made in view of the fact that the Lumbermen's Association of Texas was to meet in Waco on April 10 to 12, and much more favorable railroad arrangements could be made by combining the two events so that one convention could closely follow upon the other. Another reason for the change was the fact that the Grand Commandery is to meet in San Antonio on the dates first set for the convention of the Southwestern. The board of directors concluded that the change was advisable under the circumstances.

A very excellent programme of convention proceedings has been formulated and papers will be presented from some of the most talented men in the business in the Southwest.

Among them are the following:

Electrolysis, by E. H. Jenkins, San Antonio, Texas; Meters and Incandescent Lamps, by W. S. Rathell, Waco, Texas; Operation of Corporations from a Business Standpoint, by A. E. Judge, Tyler, Texas; Electricity *vs.* Gas for Lighting Purposes, by J. F. Cullinane, Denison, Texas; Use and Care of Electric Meters, by E. D. Kelley, Waxahachie, Texas; Street Railways from an Historical Standpoint, by F. E. Scovill, Austin, Texas; The Attitude of Municipal Corporations to the Public, by Jno. G. Boyd, Terrell, Texas; Operation and Maintenance of Street Railways, by H. F. McGregor, Houston, Texas; Paper to be Selected, by E. Dysterud, Monterey, Mexico; Paper to be Selected, by J. C. Lord, Fort Worth, Texas.

The headquarters will be at the State house.

A postal card addressed to the secretary asking for room to be secured at any of the hotels will be promptly and cheerfully attended to.

One Big Telephone Company Predicted.

President Glidden, of the Erie telephone system, who is making a tour of inspection southwest, is reported in the Galveston *News* as saying that inside of five years the telephone, telegraph and cable business of the country would be consolidated under one management, employing a capital of $250,000,000.

INDUSTRIAL NOTES

The Electric Appliance Company, Chicago, are advertising what they call their "quick construction material." They mean by this that their big stock of cross-arms, pins and brackets is in a getable shape for prompt deliveries.

Goldmark & Wallace, 121 Worth street, New York city, have issued a handsome illustrated catalogue of the "Hurricane" fan and power motors for direct current. The company is general sales agent for these goods and can supply parts as well as the complete devices.

Schiff, Jordan & Company, 232-4 Greenwich street, New York, carry a stock of "Falcon" apparatus which includes fan motors, knife switches, receptacles, switch-boards and panel-boards. This line of "Falcon" electrical apparatus is illustrated and described in a catalogue issued by the above company.

The Akron Electrical Manufacturing Company, Akron, Ohio, has recently printed an artistic pamphlet with excellent illustrations and a well-written description of the Packard recording watt-meters for alternating currents. This company, as is generally known, also manufactures a line of motors, generators, and commutator truing devices.

The Crown Woven Wire Brush Company, of Salem, Mass., report a large order of their well-known Crown and Crown K dynamo brushes from abroad. The order calls for an equal number of each type. They are intended for use in a large lighting plant. The company is sending out a number of samples of its new commutator compound which has proven very satisfactory to the trade.

The Garton-Daniels Company, of Keokuk, Iowa, is making every effort to keep up with the orders for Garton lightning arresters, but has not been able to do so, although it has recently increased its facilities, and will be making prompt shipments in a few weeks. This company's business was over twice as large in 1899 as in any previous year, and it states that present indications lead it to expect the same per cent of increase this year.

The Emerson Electric Manufacturing Company, of St. Louis, announces that it has shipped to its eastern office and warehouse, in New York city, the first instalment of the season's stock of fan motors. This consists of a carload of assorted ceiling, desk and bracket fan motors. The company will follow this with additional carloads, and will have at all times in New York city a large and well-assorted stock of 1900 model Emerson fan motors and ceiling fans.

John T. McRoy, manufacturer of the famous McRoy conduits, has issued one of the handsomest catalogues the ELECTRICAL REVIEW has seen. It is entitled "Fifteen Million Feet Under Ground," and is printed in two colors on heavy plate paper. The cover of the catalogue is beautifully embossed and the work as a whole is extremely artistic. Examples of McRoy underground conduit installations are numerous and show in an interesting manner details of construction. The catalogue reaches the consumer in a specially prepared and embossed cover.

The Electric Gas Lighting Company, of Boston, announces that in addition to its regular line of electric gas lighting material and house goods it has decided to accept orders for, and fill from stock, electric light supplies including the following: Bryan-Marsh incandescent lamps, Grimshaw covered wires, Circular loom conduit, cleats, porcelain bushings and insulators, tape and moulding, Hart switches of all kinds, and the Bryant Electric Company and General Electric Company's specialties. The Electric Gas Lighting Company states that it will supply only first-quality goods and will make shipments with its accustomed promptness.

Probably a gallery of paintings is the hardest thing there is to light satisfactorily, and the fact that all the curators of all the leading American galleries are said to unite in pronouncing the Frink system to be the best is strong proof of its excellence, for curators, as a class, are exceedingly exacting in everything that relates to the proper exhibition of the art treasures in their charge. As the up-to-date store window presents an exactly identical problem of lighting, it naturally follows that the Frink window reflector, which is the picture reflector adapted to show windows, is an ideal fixture for window lighting. No merchant who has once used it can be persuaded to make experiments with makeshifts, while those who first try the "just as good" arrangements frequently install the Frink reflector when enlarging or remodeling their stores. I. P. Frink, 551 Pearl street, New York city, is the manufacturer of this system.

The National Conduit and Cable Company, Times Building, New York city, has just issued the handsomest catalogue the ELECTRICAL REVIEW has ever received from a cable manufacturing company. It is a book 8½ by 11 inches in size, with an embossed cover in two colors. Many examples are shown of the company's installations of wrought-iron cement-lined conduits, as used in the principal American and European cities. The company's numerous types of paper-insulated wires and cables for electric lighting, power, railway, telegraph and telephone distribution are most naturally pictured. The copper cores are printed in bronze ink, the insulation and braidings in their proper colors and the lead coverings in silver. Sample sets of specifications and valuable wire tables are included in the catalogue. The National Conduit and Cable Company, which has branch offices in Boston, St. Louis and London, Eng., is advantageously equipped for the undertaking of complete underground systems. The new catalogue may be had on application.

ELECTRIC RAILWAYS

Dr. Mark Cummings, son of the late Columbus R. Cummings, has sold the Consolidated Street Railway Company, of Grand Rapids, Mich., to a syndicate represented by E. W. Clark & Company, of Philadelphia, for $3,500,000 cash.

The Brooklyn Rapid Transit Company will be better equipped to handle its great Summer trade this year than ever before. It is now receiving some of the 300 new open cars ordered some time ago, and expects to have them all ready with the return of warm weather. The company has added 500 new open cars to its equipment in two years, including the 300 now in course of delivery.

The electrical equipment on the Lexington avenue elevated line is now in readiness for operation. The company, however, is awaiting the result of the experimental electric trains now operating on the Fifth avenue branch. Trains equipped with the Westinghouse and with the Sprague motors are now in operation and the company has not decided which of the two systems it will adopt.

The Manhattan Railway Company, of New York city, is to build an extension from its present terminus, at One Hundred and Seventy-seventh street and Third avenue, to Fordham, a distance of a mile and a half, and work has been begun. The extension is expected to be completed within the year. In addition to this a new yard for cars will be provided on Lafontaine avenue, covering the two blocks between One Hundred and Seventy-ninth and One Hundred and Eighty-first streets, and the cost of these two improvements will, it is said, reach nearly $2,000,000. In the meantime the laying of the third rail for carrying electric motive power and of building the new power house at Seventy-fourth street and the East River, is progressing. The laying of the third rail was begun on the Third avenue line at Seventy-sixth street, and bids have been opened for the laying of the concrete foundation for the new power house.

Advice on Trolley Travel.

[*From the Meriden (Ct.) Journal.*]

The ELECTRICAL REVIEW says it is not unlikely that by the end of the year one may travel from Washington, D. C., to Portland, Me., by trolley cars, with only the most insignificant breaks in the continuous lines of railway. The first man who undertakes the journey will do well to take a cushion with him.

ADVANCE INFORMATION

COSHOCTON, OHIO—The Citizens' Telephone Company, of Coshocton, has applied for an amendment enlarging purpose and certificate of increase of capital stock from $10,000 to $30,000.

PHOENIX, ARIZ.—Articles of incorporation of the Electric Engine and Power Company of New York, have been filed under the laws of Arizona. The capital is $60,000,000, in 6,000,000 shares, $15,000,000 being preferred stock. The corporation runs for 25 years.

POMONA, CAL.—The Sierra Power Company has been incorporated, with its principal place of business at Pomona. Its capital stock is $75,000, divided into 750 shares, of which amount $58,500 has been subscribed. The directors are C. G. Baldwin, J. Albert Dole, B. S. Nichols, A. W. Burt and A. P. Nichols.

CAMDEN, N. J.—Former Mayor Frank A. Magowan, of Trenton, appears as one of the organizers of a $500,000 company, incorporated in Trenton. The concern is the Consolidated Light, Heat and Power Company, of Camden. Its objects are to supply electric lights and gas. The incorporators are Frank A. Magowan, Benjamin C. Woodward and Jacob W. Weart. The address of each is given as Camden.

ROME, N. Y.—The Spargo Wire Works Company, of Rome, has been incorporated with the Secretary of State to manufacture wire cables, wire cloth, wire goods and electrical supplies. The capital is $25,000 divided into 250 shares. The directors and stockholders are James A. Spargo, of Rome, who subscribed for 125 shares; Robert T. Garrison, 124 shares, and C. M. Garrison, one share, both of New York city.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Company, of Buffalo, has filed with the Secretary of State a certificate of an increase of capital stock from $3,500,000 to $6,500,000. The increase of stock is to be used in redeeming six per cent coupon gold debentures of the company. The amount of capital stock of the company actually paid in is $3,331,000, and the total amount of its debts and liabilities is $9,659,000.

CHARLESTON, W. VA.—Papers of incorporation of the Yaryan Heating and Lighting Company have been recorded in West Virginia. The capital stock of the company is $200,000, and this has all been taken by the following named persons: N. H. Swayne, W. J. Walding, H. E. Marvin, Edwin Jackson, Irving B. Hiett, W. B. Geroe, F. J. Zahm, F. M. Kelly, H. T. Yaryan, James Secor, E. D. Libbey and A. Bentley. The object of the company is to establish and maintain heating and lighting plants in the various cities of this country. At present 13 plants are under contract, and applications have been made for 52 others.

BALTIMORE, MD.—A bill to incorporate the Anne Arundel & Baltimore Electric Railway has been introduced in the legislature. It provides that the line shall start in Annapolis and run by the most available route to Baltimore. The company may also build other lines in any counties of this state; it may use any motive power other than steam, and may consolidate with other companies. Its capital of $10,000 may be increased to $800,000. The incorporators named are Charles H. Green, Charles A. Briscoe, George W. Green, Frank L. Hancock, Levin Phillips, Charles Greshoff, Frank L. Knell and Elijah Williams.

INDIANAPOLIS, IND.—Articles of incorporation for the Central Traction Company, of Indiana, have been filed. The incorporators and directors selected for the first year are Charles A. Ford, William L. Kann, George Lilly, Horace C. Stilwell and Samuel J. Mack. The capital stock is $1,200,000, divided into shares of $100 each. Ten thousand shares of the stock will be known as common and 2,000 preferred. The business of the corporation will be the building and operating of an electric road from Kokomo to Indianapolis, with various branch roads taking in the towns of Tipton, Elwood, Noblesville, Atlanta, Arcadia, Cicero, Westfield, Carmel, Castleton, Malott Park, Howland and other places. The company will also furnish heat, light and power. Several of the incorporators are interested in the American Plate Glass Company.

COMBINATION WALL AND DESK SET TELEPHONE.

Combination Wall and Desk Set Telephone.

One of the latest telephone instruments placed on the market by the Ericsson Telephone Company, New York city, is shown in the accompanying illustration—a combination instrument which can be used for either wall or desk. The magneto is without the usual gravity hook and can be used for either long or short-distance work.

When placed on a desk the magneto is put in the usual position under the desk, the same as when using an ordinary desk set. In this case the combined transmitter and receiver (called the hand microtelephone) can either be placed on the flat of the desk, in a pigeon-hole, on the top of the desk or hung on the side of the desk, if desired, or if more than one person is to use the instrument.

When used as a wall telephone, the hand microtelephone can be hung on an ordinary hook and placed at any convenient height so that it can be taken down for use either by a child or grown person. The hand microtelephone is used by grasping the handle in the left hand, holding the receiver to the ear, which brings the transmitter to a proper distance from the mouth, the switch in the handle, which is pressed by the fingers, making all the connections; when released, the instrument is cut out, the same as with a gravity hook such as is used in any ordinary telephone.

This instrument is growing in popularity on account of its utility and convenience, it being a most practical instrument for general purposes. The Ericsson Company also makes a variety of other styles of telephones for exchanges.

ELECTRIC LIGHTING

On the McCloud River, in Shasta County, Cal., will soon be installed one of the greatest electric power plants in California. Fifty thousand inches of water of the McCloud River has been secured, and this water will be brought in a canal 10 feet wide and six feet deep over 10 miles. The plant will be just above the United States fishery at Baird. Many mining companies, including the Mountain Copper Company, at Keswick, have arranged to take the power, and the company starts with contracts of 5,000 horse-power.

The certificate of merger and consolidation of the Peoples' Light and Power Company has been filed in the Secretary of State's office, at Trenton, N. J. The companies merged are the Newark Electric Light and Power Company, the Thomson-Houston Electric Company of Newark, the Essex County Electric Company, the Suburban Electric Light and Power Company, the Montclair Light and Power Company, the Central Power Company, the Consumers' Electric Light and Power Company, the Excelsior Electric Light Company of Harrison, the Kearney Electric Light and Power Company, the Hudson County Electric Company, the Jersey City Electric Light Company and the Newark-Schuyler Electric Light Company. The capital stock of the combination is $20,000,000. The officers and directors are: Philip N. Jackson, president; Dudley Farrand, vice-president; L. H. D. Gilmour, secretary; Percy Ingalls, treasurer; Randal Morgan, Matthias Plum, Jr., and William Fairlie.

ELECTRICAL PATENTS

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MARCH 13, 1900.

645,198 Process of producing incandescent materials suitable for electric lighting; G. Alefield, Darmstadt, Germany.

645,212 Electric-lighting apparatus or railroad cars; E. J. Preston, London, England.

645,259 Electric third-rail system; G. C. Hicks, Chicago, Ill.

645,261 Battery electrode; F. K. Irving, Newark, N. J.—A plate composed of lead and mercury, in the proportion of five pounds of lead to twelve ounces of mercury, and zinc in the proportion of one part of zinc to six parts of the lead and mercury compound.

645,266 Fastening device for heads of electric glow-lamps; J. Kremenezky, Vienna, Austria-Hungary.

645,284 Method of electrically treating materials; E. G. Acheson, Buffalo, N. Y.

645,377 Electrical street-indicator; G. W. Stevenson, Cramer's Hill, N. J.

645 384 Rail-joint testing apparatus; R. W. Conant, Boston, Mass.—Consists of two independent metallic circuits having a conductor common to both, and a telephone-receiver in the common conductor.

645,398 Igniter for explosive engines; L. Jones, Jr., Philadelphia, Pa.

645,4 2 Telephone-exchange system and apparatus; J. Z. Miller, Erie, Pa.—A call drop, a busy signal drop movable in front of the same, and means thrown into operation by the act of connecting together two subscribers for actuating said busy-signal drop.

645,405 Electrical music box; J. Natterer, Jersey City, N. J.

645,433 Magnetic pad; J. F. Strange, New Bedford, Mass.

645,499 Electric arc lamp; W. Vogel, New York, N.Y.

ISSUED MARCH 20, 1900.

645,547 Dry galvanic battery; Wilhelm Botz, Ludwigshafen, Germany.

645,552 Combined sleeper and conduit for electric railways; W. Courtenay, New York, N. Y.—A rail support or sleeper of composite stone which is a non-conductor of electricity, said sleeper having a longitudinal passage for wires, and a separate surface groove in which the rail rests.

645,553 Mine haulage locomotive; C. E. Davis, Chicago, Ill.—Comprises an armature and shaft, a fixed axle and a swiveled axle. said swiveled axle working in bearings rigidly attached to a cylindrical piece which acts as a bearing for one end of the armature shaft and which moves with said axle.

645,570 Telephone appliance; C. E. Scribner, Chicago, Ill.

645,571 Telephone exchange apparatus; C. E. Scribner, Chicago, Ill.

645,572 Automatic calling appliance for telephone trunk lines; C. E. Scribner, Chicago, Ill.

645,573 Electric mine-bell; B. Searle, Montrose, Pa.—An automatic magnetic make-and-break mechanism, a hermetically-closed casing for said mechanism, a movable member projecting through said casing and controlled by the magneto make-and-break mechanism, and a gas-tight liquid seal through which said member passes.

645,576 System of transmission of electrical energy; Nikola Tesla, New York, N. Y.—The method of transmitting electrical energy through the natural media, which consists in producing at a generating station a very high electrical pressure, causing thereby a propagation or flow of electrical energy, by conduction, through the earth and air strata, and collecting or receiving at a distant point the electrical energy so propagated or caused to flow.

645,588 Fire-alarm apparatus; A. F. Doddridge, Chicago, Ill.—A normally-closed primary circuit consisting of a fusible plug or cut-out, a relay magnet adapted, when the circuit is broken, to start an independent alarm mechanism and a source of electrical energy; an alarm bell adjacent to, and so connected with, said cut-out that when said fuse is burned out said bell is inserted in said circuit, and means for substantially simultaneously cutting said magnet out of said circuit.

645,599 Automatic fire-alarm; Chas. Law, Pittston, Pa.—A connector having a spring-arm integral therewith, a binding post having a slot and notches, of the arm engaging the slot, and a fusible-metal plug in one of the notches adapted to compress the arm.

645,603 Device for determining or locating grounds on electric circuits; M. J. Myers, Syracuse, N. Y.

645,612 Method of distributing energy; Geo. Westinghouse, Jr., Pittsburgh—The method of operating a long-distance electric railway, which consists in supplying electric current by local generators to different sections of the electric railway, automatically indicating at the said generators the electrical demands upon the several sections, and operating the said generators in correspondence to such demands.

645,613 Apparatus for distributing energy; Geo. Westinghouse, Pittsburgh.

645,615 Electric insulation for railways; J. E. Wright, Omaha, Neb.

645,640 Storage-battery; R. N. Chamberlain, Depew, N. Y.

645,641 Illuminated sign; G. J. Ferguson, Olyphant, Pa.

645,646 Electric railway; E. C. Morgan, Chicago, Ill.

645,647 Third traction rail for electric railways; E. C. Morgan, Chicago, Ill.

645,648 Electric railway; E. C. Morgan, Chicago, Ill.

645,654 Third rail for electric railways; W. A. P. Willard, Jr., Hull, Mass.—A contact-rail, a switch-box carrying a push-rod suitably connected thereto, with a stationary switch member, a conductor connected thereto, a switch-lever and means connecting said push-rod with said switch-lever, whereby a reciprocation of the push-rod in either direction will bring said switch member into electrical engagement.

(*Concluded next week.*)

Electrical House Goods Specialties

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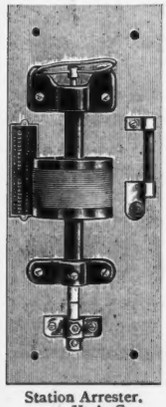

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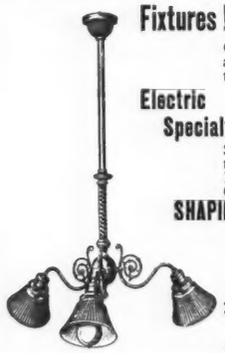

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